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THE CONVERSION OF THE LONG ISLAND RAILROAD.

Another large railroad has announced its intention to equip a considerable part of its suburban system with electric traction apparatus. This is the first railroad of any magnitude to make this announcement without the accompanying statement that the equipment was tentative and experimental. The officers of the Long Island Railroad express themselves as perfectly confident that the electric system will do their work better than the steam locomotive. The immediate reason for the change is the construction, as described in another column in this issue, of a deep tunnel to bring their metropolitan terminal into the heart of the business centre of New York City. The operation of trains in this tunnel by steam locomotives would be extremely difficult and very disagreeable to the passengers on account of the enormous amount of gases and vapor which would be liberated with the frequent service which will be required. The grades in the tunnel, although limited to 2 per cent., an almost insignificant grade with the enormous tractive effort of electric motors, would make the acceleration of steam-driven trains a serious problem. It is almost a certainty that the tunnel would not be undertaken if electric traction were not available to solve these special difficulties.

The effect of this deep tunnel on the suburban distribution systems of New York City will probably be in the nature of a revolution. The enormous advantage accruing to the delightful suburban towns and villages on the network of the Long Island road, due to their quick and comfortable transit facilities direct to the heart of the city, will necessarily cause the many other railroads reaching suburban districts on the north and west sides of the city to bestir themselves. The section of the State of New Jersey within fifteen miles of New York City contains a tremendous "commuting" population. This enormous passenger traffic has to cross the North River twice daily by ferryboats which, at their best, are disagreeable, slow and carry their passengers only to the dock line. In winter they have the further disadvantages of ice blockades, danger in fogs and general discomfort. The popular appreciation which is certain to attach itself to the Long Island terminal will undoubtedly cause the other railroads to follow the example.

The modern tendency in cities is to centre the strictly office business as closely as possible in one small area. The development of the modern steel building enables this to be done to an extent hardly appreciated as yet. The number of tenants in one of these buildings often runs into the thousands, and the buildings are still increasing in height, area and number. The remark of a railroad president that the patronage of all the tenants of just one such building would maintain his suburban service shows the magnitude of the travel to these great steel structures. The tip of Manhattan Island below Chambers Street is already dotted with many such structures, but there is still room for perhaps one hundred times as great an office population before the limits of light and air will be exhausted. That this office population will come in the official centre of all the industries of this country there can be no doubt. The railroads must anticipate and prepare for it, and their preparations will only make its coming the more rapid. Fortunately there is plenty of room underground for the many electric railroads which are eventually certain to run to the business centres of our large cities.

THE CENTRALIZATION OF GENERATING PLANTS.

In spite of the engineering difficulties in the way of building larger and larger generators the movement in that direction continues at an undiminished rate. The largest generators ever built in this country for lighting purposes are described in another column. The evolution in size has been so rapid that adjacent to these monsters in the station of the Allegheny County Light Company may be seen a row of belted machines of one-fifth their capacity. The advantages of large machines are so many and their disadvantages so few that the building of larger sizes will probably continue to limits now unthought of. As a general rule the larger the generator the greater is the efficiency, both steam and electric. Also as the generator increases in size the expenses per kilowatt of floor space, attendance, oil, maintenance and the depreciation diminish. The risk of breakdown is also, as a rule, less in large generators than in small ones: especially the breakdown of insulation, which is necessarily badly cramped when small machines are used at high voltages.

The decision of the same company to cease generating current in a station supplying 1000 arc lamps and 40,000 incandescent lights, the power for the same being transmitted from the main station 5 miles away by a step-up and step-down transmission circuit, illustrates forcibly the tendency to centralize the generation of power, and to make one large station do the work formerly divided between several smaller ones. This tendency is undoubtedly a wise one, having in its favor many of the advantages specified above for large as against small units. The further advantage of a smoother load line attaches to the combination of stations, especially where the districts served differ in the nature of their demand, as do, for example, business and residence districts.

THE DIELECTRIC STRENGTH OF OILS.

In the discussion of a previously published paper on this subject, Mr. Charles Proteus Steinmetz calls attention to the singular and interesting fact that the disruptive strength of many dielectrics is not alone a function of the potential stress to which they may be subjected, but seems to be also dependent upon the energy of the source of current. This action is probably most noticeable in the case of those substances having a relatively large dielectric hysteresis. The action in the case of oil seems to be in the nature of an insulating fatigue. The sinusoidal alternating current, with its constantly exerted electrostatic stress, disrupts the oil insulation more readily than the intermittently applied stress from the induction coil, which, in turn, disrupts more easily than the high frequency discharge with its relatively large ratio of quiescence to discharge. There seems to be a sort of inertia about the insulating qualities which resists sudden abrupt stresses, but gives way to the persistent continued ones.

There is no direction in which research and investigation are more needed than in the field of high insulation. The requirements of many present-day installations necessitate insulations far more resisting than were even dreamed of a few years ago. With the coming of high tension alternating current systems of distribution and transmission the insulator problem has grown to be one of great difficulty. To-day the limits of line working pressures, and hence the limit of effective transmission distance, is defined by the line insulators alone.

THE COUNTER E. M. F. OF THE ARC.

The good old question of the existence of a back E. M. F. in the arc still elicits much discussion. The fundamental idea of what is being discussed does not seem to be very often understood. The existence of an E. M. F., either counter or direct, means universally the transformation of electric power into some sort of energy other than heat, or vice versa; the transformation of electric power into heat direct being caused only by the passage of a current through a resistance. The transformation of electrical energy in the arc into any form of energy other than heat is manifestly absurd, as no energy can be stored up in the carbons, and there is no opportunity for the delivery of a mechanical or a chemical output. The question resolves itself into a discussion of the variation of the resistance of the arc with varying currents. The resistance of the arc is not like that of a homogeneous body, a constant independent of the current, but changes as the current varies. The nature of the change is dependent entirely on the physical qualities of the carbons, the length of the arc and various other circumstances, and the curves of these variations have been much studied and accurately determined by many able scientists. The nature of the variations, however, is such that the resistance decreases as the current increases, thereby maintaining almost a constant difference of potential across the arc, giving the idea of a back E. M. F. instead of a resistance.

This wrong conception of the action of the arc has recently led some experimenters, more fertile of resource than scientific, to adopt the extremely ingenious method of the calorimeter to determine whether there was or was not a back E. M. F. in the arc. The arc to be studied was placed in a carefully constructed calorimeter, and the absorbed electrical energy was carefully compared with the energy given off as heat and measured by the calorimeter, the assumption being made that the difference between the two would show the energy given up to the back E. M. F., and spirited out of the calorimeter in some mysterious way. Naturally, there was no difference not chargeable to the errors of observation, and the perfectly correct conclusion was drawn that there was no back electromotive force.

THE STANDARDIZATION OF ELECTRICAL APPARATUS.

A sort of criterion of the condition of any branch of technics is furnished by the approach of designs to a conventional standard of accepted good practice. In dynamo and motor construction to-day, each type, as specialized by the purpose for which it is intended, has reached a high level of excellence, and, though the prototypes of the present standard forms varied widely, there is now a great similarity of design in the work of different makers—so great, really, that the differences in most cases are of detail only and insignificant. In the design of railway power plants also this approach to conventional standards of excellence has resulted in making recently built generating plants of considerable size practical counterparts of each other.

This standardization shows no lack of originality on the part of engineers. It is, instead, a most significant indication of the high perfection of electrical machinery and methods. It is the mark of maturity in the life of the art, and should furnish a sufficient answer to those of the laity who still occasionally talk about electricity being "in its infancy."

There is another side to the influence of this tendency, however, which is not so pleasant to contemplate. It is reducing the opportunities for original practice in some directions. As far as direct-current machinery is concerned there can be no doubt that the experimental era has passed. The subject has been worked out, so to speak, and little more is left to be done in it. It is to the alternating and polyphase systems that we must look for those brilliant advances that have been so characteristic of American engineering practice. Electricians can point to-day to the fifteen years of life of the commercial types of direct-current generators, for instance, as an illustration of the completest working out of a definitely standardized system in the shortest possible time.

The Electrical Equipment of the Suburban Service of the Long Island Rail oad System.

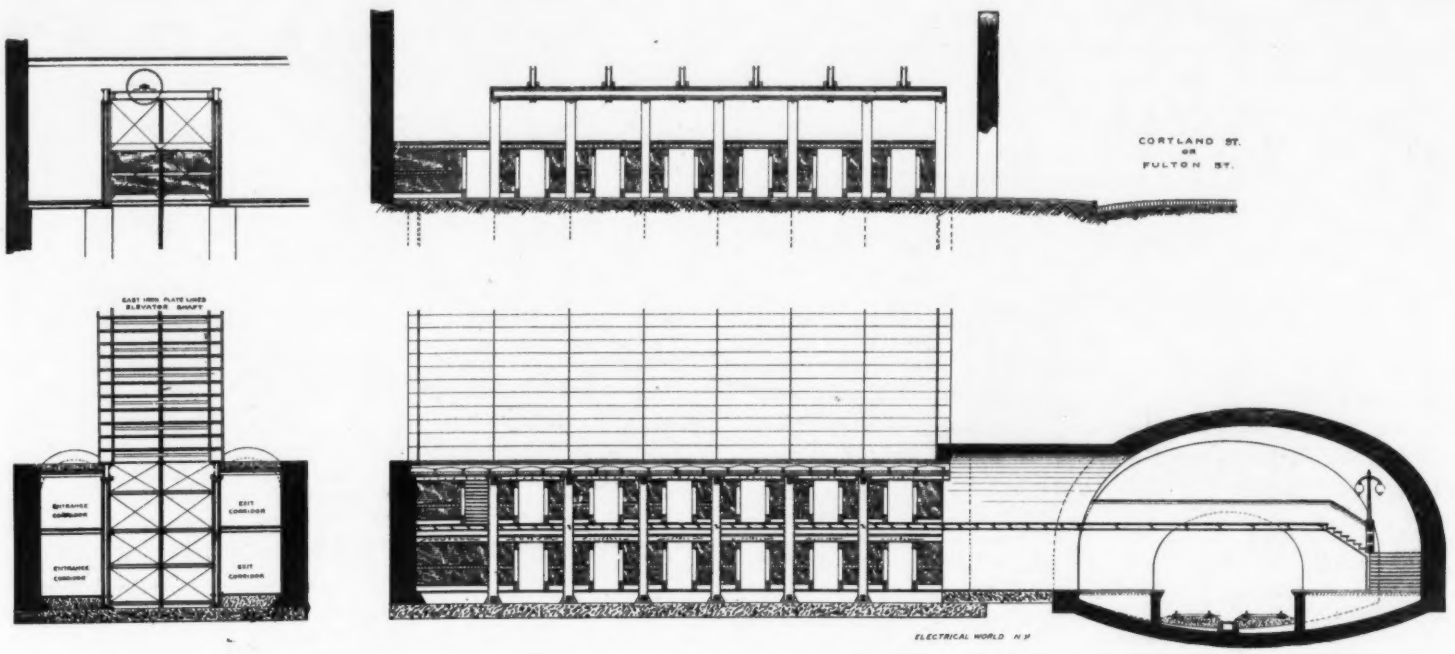
The situation of New York City on a narrow island, surrounded by deep rivers on all sides but one, has made the problem of suburban transit extremely difficult. There is only one railroad station in the city reached by the railway systems running in from the east, north and west, and this is in a part of the city several miles from the business centre. Far the largest portion of the travel to and from Manhattan Island is over ferries and the Brooklyn Bridge. There are three main lines of suburban travel—to the west into New Jersey across the North River; to the north, by way of the steam railroads running out of the Grand Central Station; and to the east into Long Island over the bridge and by the various ferries across the East River. To reach the business centre of the metropolis from any railway terminal now necessitates either a ferriage or a trip of several miles by elevated or surface street railways.

In common with other railroads centring in New York City, the Long Island Railroad system has no means of running its own trains into the business centre. There are three terminals into which its trains are run: one situated in Long Island City, to and from which ferries carry passengers from the foot of East Thirty-fourth Street, New York City, where there are terminals of the various elevated and surface railroad systems of Manhattan Island. Another terminal is at Flatbush avenue, in Brooklyn, from which passengers find their way downtown via the Brooklyn Elevated and the Bridge or ferries. Still another terminal, used quite largely by passengers to and from the famous beaches reached by the Long Island Railroad, is at Bay Ridge, from which place ferries run to the Battery, New York City.

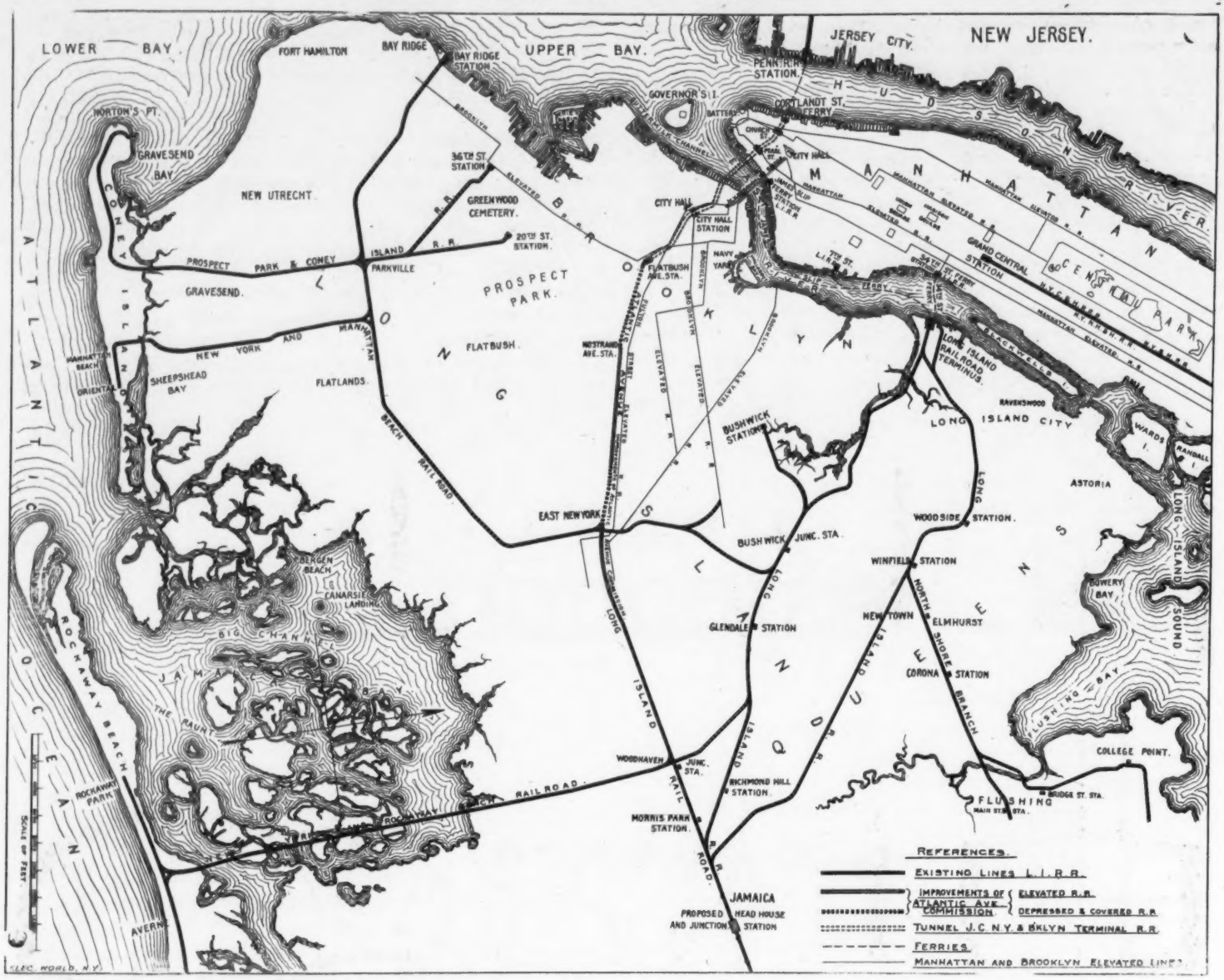
Realizing the enormous advantage which would accrue to any railroad with extensive suburban branches from ability to run its trains immediately to the business centre, the management of the Long Island Railroad Company conceived the bold project of building a tunnel under Brooklyn, the East River and Manhattan Island, connecting its present terminal at Flatbush Avenue with the congested centre of business and high buildings in the lower end of New York City. At present the Flatbush Avenue terminal of the road is reached by a double track surface line running from East New York through the middle of Atlantic Avenue. This line is fenced off from the balance of the street, but all the street crossings being on grade it introduces a considerable element of danger. To obviate this the railroad has agreed with the city to remove its tracks from grade through this whole section. The road running out from the terminal for a distance of 1¼ miles will be depressed below the surface. Advantage will then be taken of a heavy grade in the avenue to run the road out of the cut and onto an elevated structure, on which it will be carried for a further distance of 1½ miles. It will then again be depressed below the street level, coming to the surface at East New York for purposes of interconnection with the Long Island City and Manhattan Beach branches. The track is then again elevated, running for a further distance of 1¼ miles, until finally, the open country having been reached, it comes to the surface and continues as at present.

The work of substituting this 3 miles of depressed cut and cover line and 2½ miles of elevated structure for the present surface line has already been undertaken under the direction of the Atlantic Avenue Commission, appointed by the city of Brooklyn. The expense is to be divided between the latter and the railroad company, the city of Brooklyn assuming one-half the expense up to a certain maximum limit. The double tracks, depressed and elevated, as above described, will be used for express service, the present surface tracks, which constitute a private right of way, being used for local service with an equipment resembling that of ordinary street railway systems.

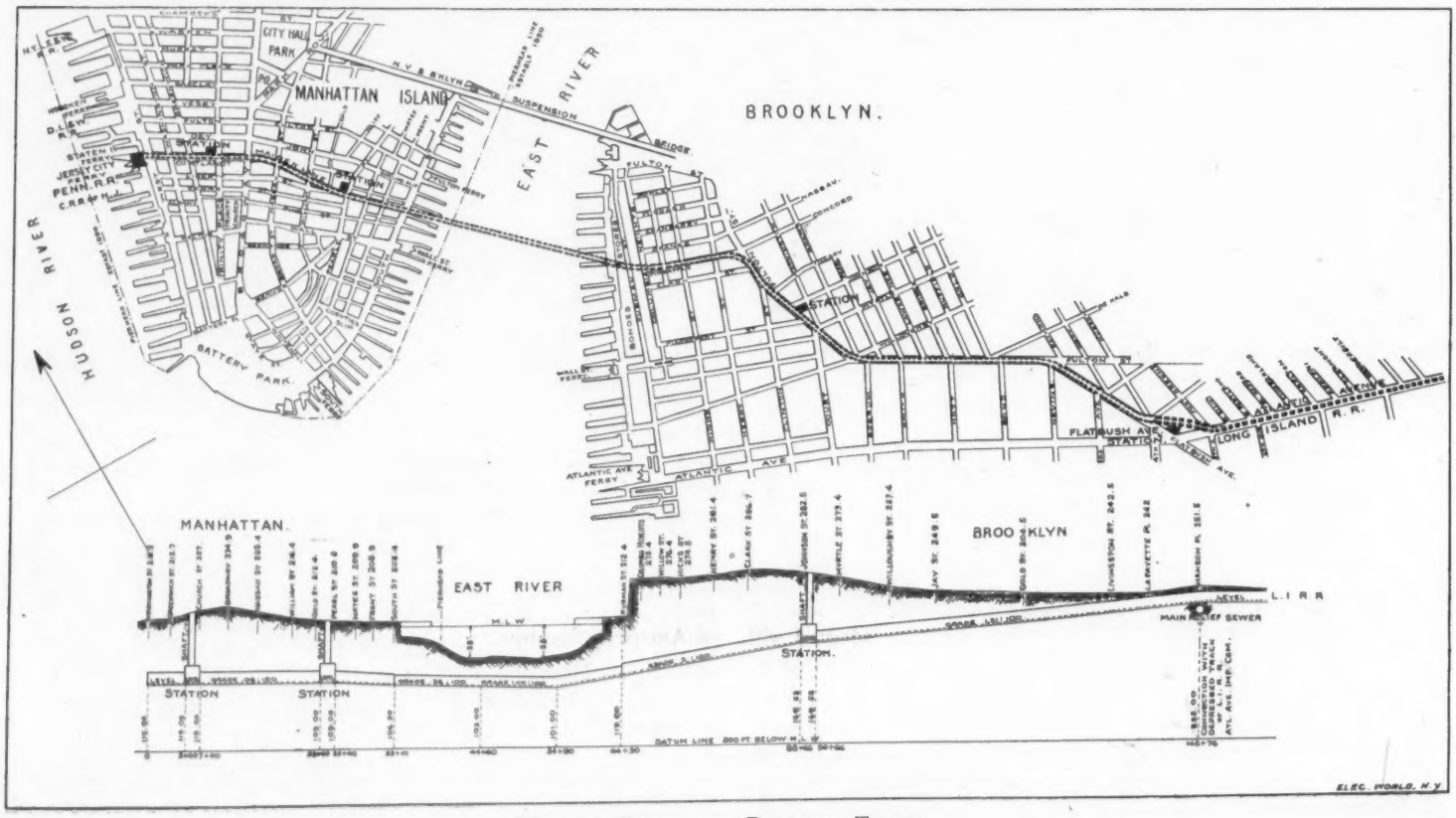
The Brooklyn, New York and Jersey City Terminal Railway Company has been incorporated, with the necessary capital, for the purpose of building the tunnel from Flatbush Avenue to the Manhattan terminal. The necessary preliminary legal steps are now being taken preparatory to the construction of the tunnel. Test borings have been made at various points to determine the nature of the strata through which the underground workings will extend. Under Manhattan Island the work will be in solid rock. Near the East River shore line of the island, at a point now being sought for by test borings, this rock falls off precipitously, and from this point the tunnel will be in sand. The rock tunnel will be double-tracked with masonry and concrete walls, while the section under the river will consist of two tubes constructed of iron, the tunnels being driven by hydraulically operated shields. This construction will be followed for a total distance of 3120 feet, after which the double track concrete construction will be resumed and carried to the terminus of the tunnel at Flatbush Avenue. Here the train will run into the depressed tracks under Atlantic Avenue. The depth of the rail level of the construction will be resumed and carried to the terminus of the tunnel at Flatbush Avenue. Here the trains will run onto the depressed feet under the low water level in the East River, from which the tracks run up the limiting grade of 2 per cent. under Brooklyn Heights. Stations will be provided with elevators rising to meet the Manhattan Elevated Railways—the Sixth Avenue line on Church Street, and the east-side lines on Pearl Street, New York City. Another station will be provided in the neighborhood of the City Hall in Brooklyn. The tunnel will be double-tracked throughout, following as closely as possible the street lines, so as to avoid the necessity of purchasing valuable real estate. For the same reason the trains will be switched from the incoming to the outgoing lines on tail tracks instead of on a loop at the Manhattan end. The accompanying illustration shows the proposed arrangement at Cortlandt Street, New York City, by which the streams of incoming and outgoing passengers are kept entirely separate, elevators delivering the former at one level and taking up the latter at another level.



PROPOSED ARRANGEMENT OF ELEVATORS AND PLATFORMS AT THE NEW YORK TERMINAL STATION.

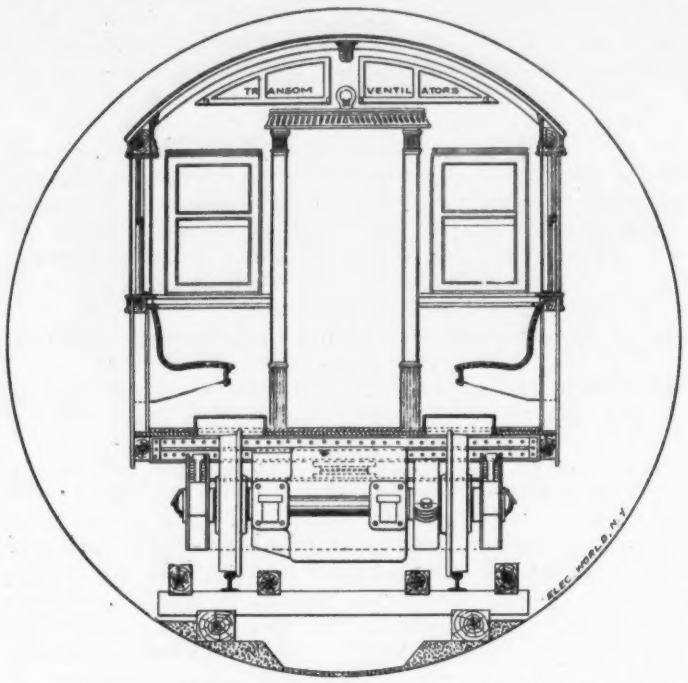


MAP SHOWING LINES OF LONG ISLAND RAILROAD, PROPOSED TUNNEL AND OTHER IMPROVEMENTS.

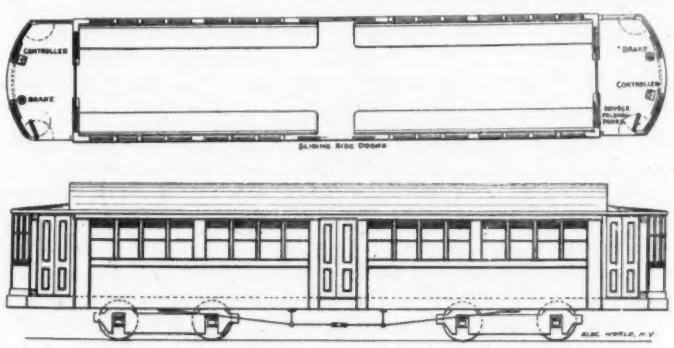


MAP AND PROFILE OF PROPOSED TUNNEL.

It is expected that the tunnel will soon be worked up to its maximum capacity. A special type of car has been provisionally adopted to economize as much as possible the space available in the single tubes, which are 14 feet 6 inches in diameter in the clear. This proposed car is somewhat similar to those now used on the Brooklyn Bridge, with ample end platforms, wide end doors, and side doors in the middle of the car at either side. No cross seats are provided, longitudinal seats only being used, and the station platforms will in all cases be flush with the car floor. In this way it is hoped to be able to empty and fill the car with passengers very promptly. The cars proposed are 50 feet long over all, with a 40 foot body and 26 feet between truck centres. The width is 9 feet 4 inches out to out and the height from floor to the centre of the ceiling is 8 feet 5 inches. The wheels are 36 inches tread and the truck wheel base 7 feet. The maximum size of motors which can be accommodated on this truck, cramped as it is vertically, will be about the dimensions of the present G. E. 55. The number of these motors necessary, per train of four cars, will depend on the maximum acceleration desired on the up grades. The assurance that this number will not exceed four per car is all that the officers of the



CAR AND TRACK CONSTRUCTION IN SINGLE TUNNEL.

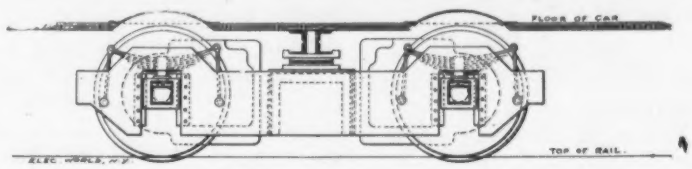


PLAN AND SIDE ELEVATION OF PROPOSED CAR.

Long Island Railroad Company feel is necessary for immediate plans. The cars will be run in trains of four each, with some system of control from the front platform not yet determined upon. The minimum headway that can be allowed is hard to determine until the tunnel is actually in use. The speed which will be adopted will be that which will give the greatest safety with minimum headway. It is hoped that trains can be run on one minute headway, at a speed of perhaps 30 miles an hour, some automatic duplicate absolute blocking apparatus being provided to prevent rear end collisions.

The electric service will extend from the end of the tunnel in New York City to a distributing head house in Jamaica. In this head house passengers for all points beyond Jamaica will change to the regular locomotive hauled trains. The electric service will also be installed on the branch lines known as the New York and Manhattan Beach Railroad, which, during the summer season, carries an enormous traffic. Even under the present adverse conditions long and heavily loaded trains run to and from Manhattan Beach on less than ten minutes' headway. This traffic will undoubtedly greatly increase with the more frequent and more convenient service that can be given through the tunnel and with electric power.

As soon as the necessary legal preliminaries are arranged, active work will be begun on the driving of the tunnel. Probably eight shafts will be sunk, giving seventeen headings on which to work.



PROPOSED ARRANGEMENT OF MOTORS.

The estimated time necessary for the construction is two and one-half years. The electrical equipment will not be finally determined upon until such time as it may be necessary to contract for it in order to have it ready when the tunnel is completed. The present plan contemplates the equipment of the through line to Jamaica and the branch to Manhattan Beach with electric power as soon as the tunnel is completed; with the further extension to all of the lines shown in the map reproduced herewith as soon as the conditions warrant it, which will probably not be long after the completion of the first lines.

Dielectric Strength of Oils.

BY CHARLES PROTEUS STEINMETZ.

In the article by Messrs. Northrup and Pierce, in THE EECTRICAL WORLD of November 6, some very interesting results are derived on the relative dielectric strength of oil and air, to wit:

First—The ratio of oil strength to air strength depends upon the source of power, being lowest under the stress of alternating currents, highest with the oscillating currents of a high frequency apparatus, and intermediate with the current of an induction coil.

Second—The ratio of oil strength to air strength increases with the striking distance; that is, the voltage, except with heavy oils and alternating currents.

Third—In the latter case the strength of oil falls to, or even below, that of air at high voltages.

The first observation seems to be the well known—though never satisfactorily explained—fact that the disruptive strength of many dielectrics, probably those having a large dielectric hysteresis, depends not only upon the voltage, but also upon the power behind the voltage. The relative disruptive effect in the above tests is in the order of the powerfulness of the source of supply, just the same order that is observed in physiological effects, where, as is well known, the high frequency coil discharge can hardly be felt, that of the induction coil is quite severe, and that of the transformer dangerous.

I do not believe that the shape of the wave is the cause of the differences. If, as is probable, the alternating current is derived from an iron-clad machine, with the enormous self-induction and considerable capacity of the induction coil used as transformer, the alternating wave probably differs far more from sine shape than the oscillation of the high frequency apparatus. With the alternating wave, however, the dielectric is continuously exposed to an electrostatic stress, while with an induction coil and still more with a high frequency apparatus, short periods of high electrostatic stress are separated by intervals of rest, which are very long compared with the time of activity.

Some years ago I made a number of tests with alternating currents on the dielectric strength of different materials (Transactions of American Institute of Electrical Engineers, February, 1893) which gave for air in the range up to 25,000 volts a parabolic law,

$$d = 54\ V + 1.2\ V^2,$$

but for paraffine and oils straight lines:

Paraffine paper, $d = 3\ V$.
Melted paraffine, $d = 12.4\ V$.
Boiled linseed oil, $d = 12.5\ V$.
Crude lubricating oil, $d = 60\ V$.

Herefrom it follows immediately that the ratio of oil strength to air strength must increase with the distance; that is, the voltage, as observed in above mentioned tests.

There remains unexplained, however, the enormous drop of the oil strength to and below that of air in the case of heavy oils with alternating currents. Nothing of this kind was ever observed by me, nor I believe by anybody else, but contrary evidence is quite plentiful. For instance, during the last three years I have had four high potential oil transformers in frequent use for insulation tests, sometimes for hours at a time, at voltages from 60,000 to 150,000, corresponding to a striking distance of from 7 to 16 inches of air. The total insulation or oil distance from terminal to terminal in these transformers does not exceed about 4 inches. Thus, if the oil (a transformer oil similar to transil oil) had fallen anywhere near to air in dielectric strength, the transformers would have broken down long ago.

Heavy oils very frequently occlude moisture, and occasionally acids, and I should suggest this property as an explanation of their abnormal behavior under alternating stress in these tests. A similar effect takes place in condensers. If the dielectric of an electrostatic condenser occludes air, in an alternating circuit the condenser breaks down after a short time at a remarkably low voltage, while on powerless sources of potential difference it is practically as strong as if the air were perfectly excluded.

There can be no doubt in my mind, however, that at high voltages with alternating currents, dry oils have a dielectric strength far superior to that of air.

A Study of Electrical Insulation—III.

BY FREDERICK WILLIAM PHISTERER.

SULPHUR.

There are two ways in which sulphur may be used in combination with other substances as an electrical insulation. It may be added to the other substances by melting at a low heat, or it may be made to combine chemically at a high temperature.

For the purpose of these experiments, the various materials already mentioned were used, and the sulphur was added in this way: Five lots, each weighing 100 grams, were taken, and to the first was added 1 per cent. by weight of powdered sulphur. To the next lot were added 2 per cent. of sulphur, and so on up to 5 per cent. The material was melted at a low heat, so as not to give off any fumes. When it was perfectly fluid, the sulphur was stirred in and thoroughly mixed. It was then allowed to cool until almost hard, and again melted over a slow heat. When the mixture was fluid enough to pour its temperature was taken, and this temperature was considered that of its melting point.

As might be expected in the case of a mixture made by melting two substances together, the melting point was steadily, and in some cases rapidly, lowered. There were, however, no other changes in the physical properties, so far as could be noticed, except perhaps, a slight hardening in mixtures containing the larger percentages of sulphur.

In all, forty mixtures were made in this manner, five with each of eight substances. Very uniform results were obtained in every case.

The data, average of forty tests made, show that there is nothing to be gained by melting sulphur with any other substance to form an insulation. Instead of a gain, there is a decided loss, due to the lower melting point, and this loss increased with the per cent. of sulphur present in the mixture.

The other method of using sulphur was to cause it to combine chemically with the various substances. This was done in this manner: Portions weighing 100 grams were melted, and to each was added a certain per cent. by weight of finely powdered sulphur, from 1 to 5. The heating was continued until the mixture boiled, and then the sulphur entered into chemical combination, liberating hydrogen sulphide. Before the liberation of the gas the mixture was very fluid, but as soon as the gas began to be given off the mixture became almost stiff enough to hold upright the stirring rod. As soon as the gas was all driven off, the mixture again became fluid, and was then allowed to cool. It was then remelted at a low heat without giving off any fumes, and its temperature taken when fluid enough to pour. This was considered as the temperature of the melting point of the mixture.

The addition of sulphur by melting to any of the substances tested, lowered the melting point very rapidly and increased the brittleness of the mixture.

When sulphur is caused to enter into chemical combination with any of the substances, hydrogen sulphide is generated. These tests show that if the substance be already hard, the melting point is lowered by a small amount of sulphur, but rapidly raised by larger quantities. However, the materials are already too hard and brittle to use as an insulation. In the case of those substances already soft and flexible enough to use, the addition of sulphur caused generally a rise in the melting point, but the increase of hardness and brittleness was so rapid as to render these mixtures also useless.

Refined Trinidad asphalt by itself melted at 350° Fahr. The presence of 1 per cent. of sulphur lowered the melting point, but with increasing proportions of sulphur the melting point rose. The sulphur also caused an increase of hardness and brittleness.

Refined Bermuda asphalt melted at 295° Fahr. The presence of 1 per cent. of sulphur lowered the melting point about 65°, but increasing proportions of sulphur raised the melting point steadily. Sulphur also increased the hardness and brittleness of the mixture.

Refined California asphalt alone had its melting point at 295° Fahr. Adding 1 per cent. of sulphur raised the melting point 30°, and 2 per cent. of sulphur raised it 50° more. The higher percentages of sulphur acted as explained above.

No. 1 refined Trinidad asphalt had its melting point at 295° Fahr. The presence of 1 per cent. of sulphur raised this 30°; 2 per cent. of sulphur raised it 50° more, but the melting point went no higher for the higher percentages of sulphur. The hardness and brittleness of the mixture were also markedly increased.

Soft coal-tar pitch alone had its melting point at 210°. The presence of 1 per cent. of sulphur lowered the melting point 30°; 2 per cent. of sulphur raised it again, and the melting point reached the maximum of 310° with 3 per cent. of sulphur. With 4 and 5 per cent. it again dropped to 260°. Even 1 per cent. of sulphur increased the hardness and brittleness and decreased the flexibility and flow. These changes increased with the higher percentages of sulphur, and became very marked in the mixtures containing 4 and 5 per cent. of sulphur.

Mineral wax by itself melted at 235° Fahr. The presence of 1 per cent. of sulphur lowered the melting point 35°, and but very slightly increased the hardness and brittleness. The addition of more sulphur lowered the melting point but slightly, but very rapidly increased the hardness and brittleness.

Sapho alone melted at 210° Fahr. One per cent. of sulphur lowered the melting point 10°; 3 per cent. raised the melting point to 200° again, and 5 per cent. raised it 10° more. With the increased percentage of sulphur in the mixture the hardness and brittleness increased, until, with 5 per cent. of sulphur, the mixture was so brittle as to crumble.

By itself, ozite melted at 180° Fahr. Adding sulphur to it raised the melting point, but at the same time very markedly increased the hardness and brittleness, and decreased the flexibility and flow.

Hard coal-tar pitches:

One per cent. of sulphur added to either of these substances lowered the temperature of the melting point, but increasing the percentage of sulphur in the mixture rapidly raised it again, and markedly increased the hardness and brittleness. Five per cent. of sulphur raised the melting point considerably above that of either alone.

SILEX.

This material is manufactured and sold under the name of "Silex" by the Silex Insulation Company, of New York City. It is chemically pure silicon, or dioxide of silica, ground so fine as to be like flour in appearance and to the touch.

The manufacturers propose to use it by putting bare conductors in an iron pipe and surrounding them with a solid packing of silex. It can be packed in around the wire until it approaches the original rock in solidity and yet not being absolutely solid, it allows for expansion of the wire, or for bending of the pipe without displacement. It is absolutely dry, and must be kept so, for while it will not absorb moisture, water will mix with it, completely destroying its insulating properties.

The object of these experiments was to find some method of waterproofing silex without destroying its good properties of high-melting point and flexibility. It was useless to consider any mixture of silex and any material not in itself very tough and flexible and possessing a marked flow. For this reason no tests were made with any of the asphalts or coal-tar pitches. No tests were made of paraffine wax in combination with silex, as the paraffine is known not to be moisture proof.

It was thought that possibly silex could be added to the very

tough and flexible substances used, in such quantities as to, of necessity, raise the melting point without appreciably increasing the hardness and brittleness of the mixture.

To do this a certain weight of the waterproof substance was taken and melted at as low a heat as possible. In these tests a weight of 100 grams was taken. To this when melted 25 grams of silex were added and thoroughly stirred in. The mixture was then allowed to cool, and again melted over a slow heat until it became fluid enough to pour. Its temperature was then taken, and this was considered to be the temperature of its melting point. Again silex was added, each mixture containing 25 grams of silex more than the one before it. The process was continued until the mixture either became hard and brittle or until it became dry, and would take up no more silex.

Tests were made with silex and mineral wax and silex and ozite.

Mineral wax by itself melted at 235° Fahr. The addition of 25 grams of silex lowered the melting point of the mixture to 195°, and it was not until 175 grams had been added that the melting point rose above that of the wax alone. When 200 grams had been added the mixture could no longer be melted at so low a heat as to prevent fuming, which from this point on increased with the quantity of silex present. At 340° the mixture containing 275 grams of silex was so thick and heavy that it poured very slowly. Three hundred grams of silex raised the melting point to 375°, and although the mixture could hardly be said to pour, it was soft enough to allow the stirring rod to be moved through it, and would therefore permit the displacement of a wire. The mixture containing 325 grams of silex would not melt enough to pour. It was so thick and heavy that the addition of heat seemed to have no effect other than to distill off or dry out the mineral wax. Although the mixture was slightly soft, it was not enough so as to allow the passage of a wire through it by its own weight, except perhaps so slowly that the eye could detect no movement even after some time. At ordinary temperatures it was rather hard, and not very easily marked with the finger nail. It was very tough, and showed only the slightest signs of cracking even after repeated very hard sudden blows. There was some slight flow noticed by the closing of the cracks after standing some time. It was decided to continue the addition of silex to determine if possible how much would be taken up by the mineral wax. The mixture containing 375 grams of silex could only be stirred with great difficulty, and that containing 400 grams became so dry that not all of the silex could be stirred in.

Nothing is to be gained by the addition of silex in any less ratio than 175 grams of silex to 100 grams of mineral wax, for it is only at this ratio that the melting point rises to that of the wax alone. With greater ratios the melting point rises uniformly and above the ratio of 250 to 100 rapidly, and the mixture went dry when the ratio reached that of 4 to 1.

With ozite.

In the same manner as described for the experiments with mineral wax silex was added to 100 grams of ozite.

Ozite melted at 180° Fahr. The presence of 25 grams of silex lowered the melting point 40°. Adding more silex slowly raised the melting point until, with 150 grams of silex, the melting point was again equal to that of ozite alone. From this point the further addition of silex caused fairly regular increases of the melting point. until with 325 grams of silex the melting point had risen to 320°. The temperature of the melting point of the next higher mixture was not taken, for it was found that the mixture was hard and quite markedly brittle.

The addition of small quantities of silex produced the bad effect of lowering an already low melting point. In ratios of 1.5 of silex to 1 of ozite the melting point is equal to that of ozite alone. Above this ratio the melting point rises regularly with the increased proportion of silex, but it is a question if anything is gained by a greater ratio than 325 grams of silex to 100 grams of ozite because of the increase in hardness and brittleness.

PART II.

ELECTRICAL PROPERTIES.

This part consists of a study of the electrical properties of the various mixtures, as shown by the voltage necessary to cause a "breaking down" of the insulation. Only those specimens were tested that were shown by previous experiments to have more or less satisfactory physical properties.

A storage battery and induction coil were used to supply the electrical energy. Two sets of discharge terminals were made, one to be used as a spark gap and the other to receive the test piece. The terminals were so arranged that the distance between the points could be easily varied and accurately measured. It was not possible at the time to obtain ball discharge points, so heavy copper wire was used instead.

The test pieces were made by melting each mixture and pouring it into a mould. These moulds were cardboard boxes, having in the bottom a thin flat disc with a hemispherical piece at the centre. By covering the moulds with paper the mixtures were prevented from sticking to them. Breaking off the top and bottom of the box and removing the flat disc left a test piece ready to be put between the terminals. The test pieces were about 3 inches in diameter and 1 inch thick at the circumference. This thickness was uniform for about three-fourths of an inch inward from the edge. From this point on the thickness of the test piece was uniformly diminished by the hemispherical concavity caused by the knob at the centre of the flat disc mentioned above. This thickening of the test piece at the outer edge, and leaving it thin only at the point where the breaking-down action was to take place, was done to avoid the condenser effects. It has been found in previous tests that great difficulty attends all efforts to obtain the successful puncturing of a thin test piece. Because of its thinness very marked electrostatic effects are noticed, and because of the creeping of this electrostatic charge the discharge takes place over the edge of the dialectric instead of through it. Were the whole test piece made thick no means of puncturing it could be obtained. By making the specimen thin at the centre it was easily punctured, and making it thick for some distance all around the thin place prevented the creeping of the electrostatic charge. For the thicker the dielectric the less is this condenser effect. No difficulty was experienced during these experiments due to the discharge taking place over the edge of the specimen.

Each specimen was in turn placed between one set of the discharge terminals, with the points of the terminals slightly imbedded beneath the surfaces of the specimen. The distance between the points of the other set of terminals was then increased by a succession of short distances until the discharge took place through the test piece instead of the air. As far as possible, approximately equal periods of time were allowed for each voltage. After the test piece had broken down, the distance betwen the points of each set of terminals was recorded, together with the numbers designating the specimens. From this data the length of spark gap per one-hundredth-inch of insulation was obtained by calculation, and then the breaking-down voltage was taken from a curve showing the relation between length of spark gap and the volts necessary to cause sparking. This curve was found in J. J. Thomson's "Recent Researches in Electricity and Magnetism," on page 79, Fig. 22, which is taken from a paper by De la Rue and Hugo Miller (Phil. Trans. 1878, Pt. 1, p. 55).

The values of the voltage for all spark lengths per one-hundredth inch beyond four-tenths inch are doubtful, for they were obtained only by prolonging the curve mentioned above.

Owing to the fact that but one specimen of each mixture could be obtained none of the results in this part could be verified, but the probability of error is not great, because of the accuracy with which the distances between the terminals of the spark gap could be measured.

Statistics of Electric Lighting in Paris and London.

At the end of October, 1896, there were in use in Paris 545,914 electric lamps and in London 1,178,000, according to *Zeitschrift fur Architectur*. The feeding current was, in Paris 8,107,253 kilowatt-hours, and in London 10,000,000 kilowatt-hours, approximately. In Paris the price per kilowatt-hour was 1.25 franc and in London .65 franc.

Honors to Professor Hughes.

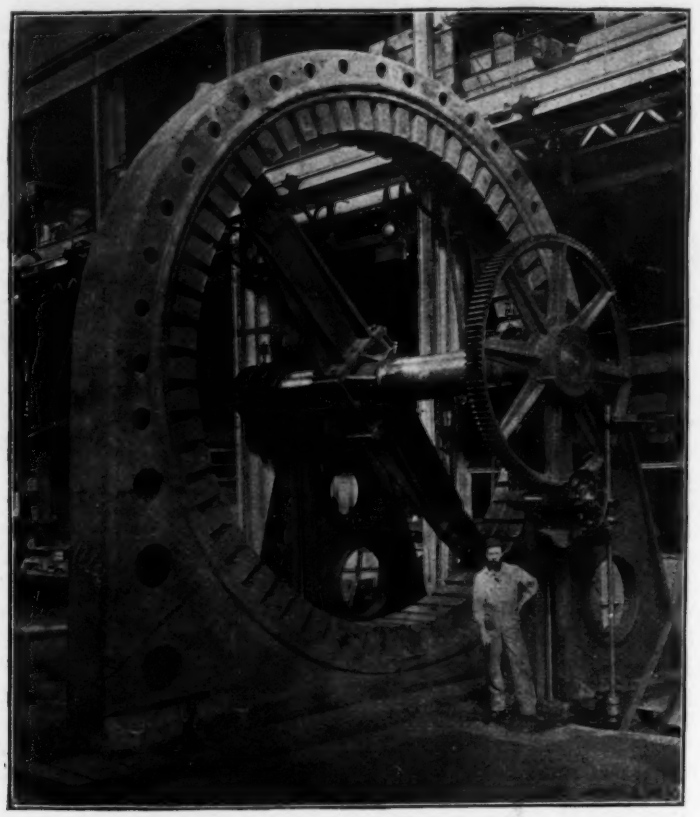
According to the English journals the declaration of "Officier de l'Ordre Léopold" has just been conferred upon Prof. D. E. Hughes, of London, by the King of Belgium. The Hughes type-printing telegraph has been used largely on the Belgian Government lines for over twenty-seven years.

1500-kw Generators at the Station of the Allegheny County Light Company.

BY P. H. THOMAS.

The great advantage to lighting companies of units of large capacity over the older multiplicity of small machines, is well illustrated at the reconstructed plant of the Allegheny County Light Company, of Pittsburg. This company supplies light, both arc and incandescent, to the city of Pittsburg and the neighboring boroughs of Glenwood, Knoxville and Mount Oliver, as well as supplying all the incandescent and commercial arcs in the city of Allegheny, altogether a district of at least ten miles in length and somewhat less in width. The total number of arc lights supplied by the company is 2500, and

Generator Assembled in Place.



Boring the 1500-kw Field Poles.

the number of incandescents connected about 110,000. The company also supplies motors from direct-current mains at 500 volts.

Incorporated in 1881, this company started on alternate current work in 1887 with ten 1200-light A. C. generators, the total number of lights connected being 250 arc and 5000 incandescents. The 1200-light generators were soon replaced by 2500-light machines, which in turn gave way to generators of 3000-light capacity, and later 4000-light capacity. All these machines were made by the Westinghouse Company, and were wound for 1200 volts, which was considered at the time the most practicable voltage. Four 1500-kw machines are now being installed, which will each supply 312 amperes on each of its two phases at 2400 volts, the capacity of each machine in 16-cp lamps being 20,000.

The four 1500-kw generators together have twice the capacity of the ten 4000-light machines which they replace, and occupy considerably less space. But the gain in space resulting from using large units is not the only saving; there is also a great gain in efficiency, both in engines and generators.

These generators were built by the Westinghouse Electric and Manufacturing Company, and, except the 5000-hp quarter-phase machines at Niagara, are the largest A. C. generators in operation.

The central power station of the Allegheny County Light Company, on Twelfth and Ætna Streets, in which is to be concentrated all the generating apparatus of the plant, is a substantial brick building, erected under the personal supervision of Mr. W. J. Hunker, the superintendent, who has been connected with the company since 1887. The dynamo room is 100 feet by 200 and is 34 feet in height from the floor to the lowest chord of the roof trusses. The walls are of white enamel brick and a 10-foot basement is provided for wiring, piping, etc. The four 1500-kw units are placed on one side of the dynamo room, in a row between the older belted machines and the wall.

The dynamo room is traversed by a 30-ton electric crane, supplied by the Morgan Engineering Company, Westinghouse motors being used. The present appearance of the dynamo room is shown in the illustration. The ten 4000-light, 1200-volt machines, belted to Westinghouse engines, appear in the foreground, while the four 1500-kw units are seen on the left. It must be remembered that the larger units have a capacity twice that of the smaller.

In the same building are offices, repair shop, draughting room, laboratory, and dining room and kitchen for the use of the office force. The boiler house adjoins the dynamo room. The boilers are Babcock & Wilcox, and are arranged on two floors, eight boilers on each floor. They aggregate 4500 horse-power (nominal), but are worked considerably above their rated capacity on the peak of the load. Six more boilers are soon to be added. A double system of steam piping is provided throughout. Three of the 1500-kw units will supply the constant potential mains of the company, the fourth being held in reserve.

The engines were built by the Westinghouse Machine Company, and are marine type, cross compound, two cylinder engines of 2000 nominal horse-power. A Worthington jet condenser of 6000 horse-power is to be used, space being allowed for another condenser of the same capacity. This condenser will be the largest jet condenser in the United States, the next in size being that of the Buffalo Street Railway Company, which has a capacity of 4500 horse-power. A 4-foot tunnel 600 feet long will supply condensing water from the Allegheny River.

The generators are wound to give 2400 volts at 116 revolutions per minute. As they have sixty-two poles the alternations are 7200 per minute, or sixty complete cycles per second. These machines have a remarkably low coefficient of self-induction, and will maintain their voltage within 6 per cent. from no load to full load with constant speed and field excitation. The efficiency is 94 per cent. at full load and 91 at half load.

As is usual with large machines the socalled engine-type form of construction has been adopted, with rotating armature and stationary field. In the engine-type machine, engine and generator are designed as one unit, which, beside its other advantages, permits a smaller number of bearings and requires less space than the old method of coupling complete and independent engine and generators. In these machines there are five bearings, three in the engine, one for the generator and one between engine and generator. No separate fly wheel is provided, as the armature itself is designed to serve this purpose.

The outside dimensions of a complete unit are 33 by 28 feet, but much of the space represented by this rectangle is available for other purposes, such as steam separators, etc. The total height from

foundation to top of field yoke is 22 feet 7 inches. The bed plate of the generator is nearly 6 feet below the floor level at which the engine base stands. The weight of the complete generator is about 225,000 pounds, that of the armature being about one-third of the total.

The field yoke is split vertically and may be separated sufficiently on the bed plate to take out field coils. As the machines are here installed space is also provided for sufficient lateral motion to permit the removal of the armature.

Current is taken from the revolving armature by means of a four-ring collector. Two copper brushes take the 350 amperes that may be drawn from each ring. This collector is placed on the shaft on the outer side between the bearings, and is of the standard Westinghouse type, having mica insulation at all points.

Exciting current is obtained from small Westinghouse generators direct connected to Westinghouse engines, two 75-kw and one 37½-kw units being provided. The voltage of the exciters is 250.

The armature spider is of cast iron, in two parts, bolted together and secured by shrunk rings. This spider has eight spokes and carries on its periphery steel punchings which contain the slots and windings. To make these punchings of a convenient size thirty-eight are used to form one complete circle around the armature. Each punching has two lugs on its inner edge which dovetail into suitably shaped grooves in the spider. The spider without the punchings is shown in one of the illustrations.

The armature core, which is nearly 17 feet in diameter, is built up in a horizontal position, and the punchings are alternated so as to break joints; that is, each punching covers the joint between the two above or below it. This method of building practically avoids the undesirable effects of an air gap in the magnetic circuit that would otherwise occur where adjacent punchings meet. The magnetic lines of force, so to speak, on reaching the edge of a punching, pass to the plate above or below and return in the same manner to the next punching. Furthermore, this method of lapping punchings of course gives great mechanical strength and rigidity to the core; in fact, it immediately suggests the boiler plate fly wheel.

The slots are nearly enclosed; that is, each tooth has an overhanging head, which renders unnecessary any bands, or wood or fibre strips to secure the conductors in position, and also protects the coils from mechanical injury to a very considerable extent. When the punchings have been built up on the spider they are subjected to a great pressure and secured in position by heavy cast steel end plates. One of the figures shows one of these armature cores built up, with the winding in place.

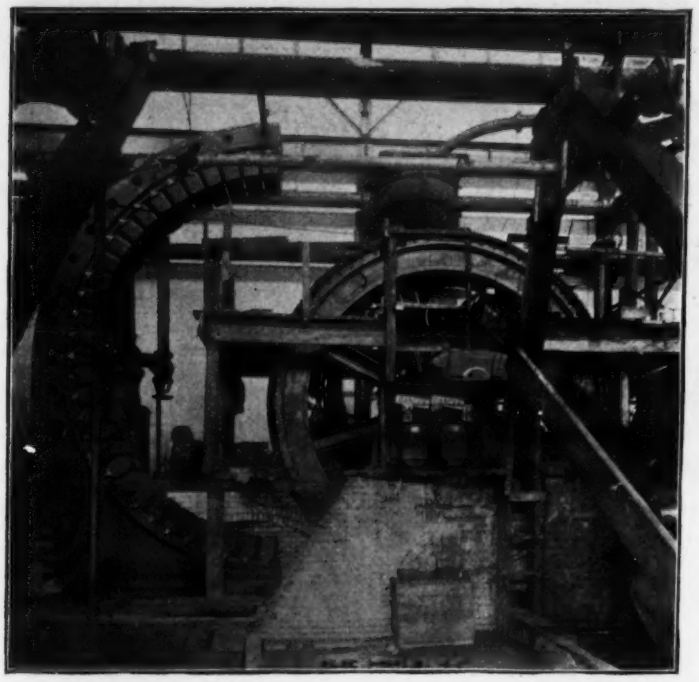
GENERATOR ROOM OF THE CENTRAL STATION OF THE ALLEGHENY COUNTY LIGHT COMPANY. THE OLD AND THE NEW.

ARMATURE SPIDER WITHOUT CORE PLATES.

One feature of the construction of these armatures deserves special mention. The spider is so designed as to allow free access of air to the inside of the punchings, which are divided at intervals by cast brass spacing strips. These spacing strips being so shaped as not to

obstruct the passage of air, act as centrifugal blowers, forcing air through the ducts, thus cooling both iron and conductors, and, to a considerable extent, the field coils as well.

The winding is of the closed circuit type; that is, is closed on itself, the four collector leads being taken off at four points equidistant from one another on the winding. Each slot contains one conductor, the bars being connected on the ends by suitably shaped end connectors, according to the standard method of the Westinghouse Company with windings of this sort. The bars are made alternately long and short, so as to allow the end connectors to pass one another. The conductor in each slot consists of a rectangular copper bar, which is carefully insulated and tested before being placed in position. As this insulation contains considerable mica it will run satisfactorily at much higher temperatures than it will ever be called upon to stand. All joints are carefully bolted and soldered, and thoroughly insulated, so that the windings present a very neat appearance. When the armature is completed it receives an insulation test, in addition to the tests on the individual bars.



Armature Wound, Field Being Placed in Position.

The armature spiders of these machines were shipped in two parts, the armature core being built up and the winding done at the station of the Allegheny County Light Company. This arrangement very much facilitated shipping operations, as well as avoiding danger of injuring the winding in handling.

As stated above, the fields are in two parts, separating on a vertical plane. The yoke is of cast iron, into which the poles, built up of steel punchings, are cast. In addition to the usual section of yoke for magnetic purposes, a large hollow back is provided to add stiffness.

The field coils, one to a pole, are of heavy square wire, lathe wound, and are supported in position on the poles by brass castings on the inside of the end. This method of support is of advantage in that it leaves practically all of the surface of the coils available for cooling purposes.

The switchboard arrangements are very simple. Cables run direct from the generators to the instruments and to the large pneumatically handled switches, which are connected between the machines and the bus bars. These switches are similar to those used by the Cataract Construction Company, at Niagara Falls, in connection with their 5000-hp generators. The usual instruments are provided, also of the Niagara type. As the machines are to be run in parallel, synchronizing apparatus is provided. The cable leads connecting the generators with the switchboard are of 450,000 circular mils section, four to a generator, and are all lead covered. They are carried under the floor, as are also all feeder cables. For wires leaving the building two tunnels are provided, one for the 2400-volt cables and the other for the arc circuits. The tunnels run out of the building, where they connect with the pole lines.

The section of the city of Pittsburg known as the East End is at present supplied from a separate station, operated, however, by the Allegheny County Light Company. This station has connected about 40,000 incandescent lamps and about 1000 arcs. It will soon, however, be supplied from the Twelfth Street station by means of raising and lowering transformers and a transmission line. Fifty-five hundred to 5000 volts will be used, and two circuits of three wires each will connect the two stations, No. 1 insulated wires being used. The transformers are of the two-phase-three-phase system of the Westinghouse Company, so that the transmission is three-phase, giving the greatest economy of copper. The length of the line is 5 miles and the entire distance lies through a thickly populated district.

The company has also a station in the city of Allegheny at a short distance from the Twelfth Street station, from which 220-volt D. C. circuits are supplied. It is the intention of the company to place rotaries in this station and to install a storage battery, the energy being all supplied bythe Twelfth Street station. The storage battery will then, through the rotaries, be able to assist the generators and engines on the peak of the load. These arrangements represent the latest ideas in station economy, and combine most of the advantages of several systems.

The reconstructed plant of the Allegheny County Light Company, both as to type of machines and general arrangements, will illustrate the present tendency of the more progressive companies toward the use of large units and, when necessary, high voltage transmission to a distance.

For the information given above about the Allegheny County Light Company the writer is indebted to the kindness of Mr. W. J. Hunker, superintendent of the company.

The Proposed Consolidation of Covered Wire Interests.

There seems to be a lack of unanimity of opinion in the wire trade regarding the proposed consolidation of the interests of rubber-covered wire manufacturers, as outlined in the last issue of The Electrical World. The daily papers last week paid considerable attention to the subject in their columns, the *Tribune* and *Sun* giving the names of the concerns said to be interested in the deal.

Those named were the General Electric Company, the Western Electric Company, the Safety Insulated Wire & Cable Company, the Okonite Company, the New York Insulated Wire Company, the Gutta-Percha & India Rubber Insulating Company, the American Electrical Works, the Eastern Electric Cable Company, W. R. Brixey, the Simplex Electric Company, J. A. Roebling's Sons Company, Washburn & Moen, the Bishop Gutta-Percha Company, the Standard Underground & Cable Company and the Crefeld Electrical Works. Inquiry among some of the wire companies for further information on the subject failed to elicit anything more definite than the statements contained in the article first referred to. Indeed, the interview held by the representative of The Electrical World with several gentlemen more or less interested in the combination leads to the belief that there is no immediate prospect of consummating the proposed deal. Mr. W. R. Brixey denies that he has had anything to do with the proposition, and states that he has no intention of becoming a party to such a compact. At his office the statement was made that they knew nothing whatever of the proposed arrangement. Captain Candee, of the Okonite Company, stated that no combination had been effected, and none was likely. The difficulty of carrying such a proposition into practice, he said, was in adjusting the terms and details satisfactorily to all interests concerned. The Okonite Company, he stated, has nothing to do with the alleged arrangement, and the report that the combination was to be effected, he stated, was not true. At the office in this city of the General Electric Company no information could be obtained, one way or the other.

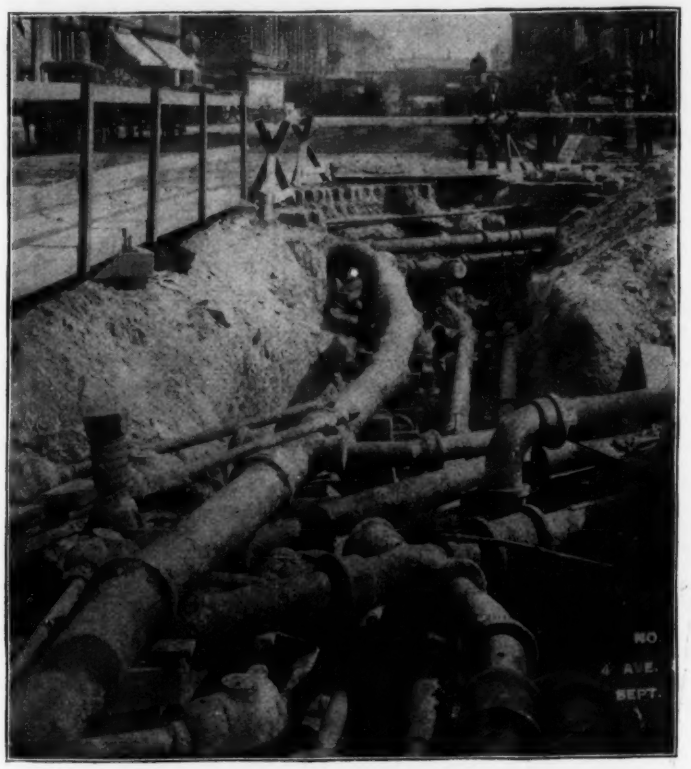
Electric Motors for Emergency Work.

According to the London *Electrician* a curious accident recently happened to a gas engine in the works of Messrs. Nalder Brothers & Thompson, London. Owing to a flaw in the shaft it suddenly snapped off short outside the bearing. The flywheel, weighing 780 pounds, and the pulley were thus dropped on the floor while running at a rate of 300 revolutions per minute. Fortunately the belt remained on the pulley, and pulled up the flywheel without any serious damage resulting. A motor company was immediately telephoned, and forwarded at once an alternating-current motor, by the aid of which the shops were running again the same evening.

The Electric Conduit Roads in New York City.

On November 1 the first section of the new underground conduit roads, built by the Metropolitan Street Railway Company, was put into service. These conduit roads, which were described in THE ELECTRICAL WORLD of August 28, are being built by the Metropolitan Street Railway Company to replace the many scores of miles of horse-car lines operated by that company over the greater part of the Island of Manhattan. The construction, which was described in the article above referred to is of the most thorough and painstaking kind, the matter of expense being quite subservient to the requirements of a system durable, substantial and as nearly perfect as possible.

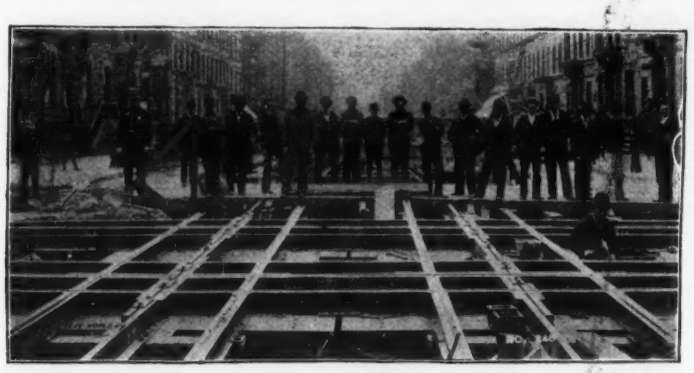
The difficulties involved in the new work were great, as may be seen by one of the accompanying illustrations, which shows the pipes which it was necessary to remove in order to make way for



A SLIGHT OBSTRUCTION.

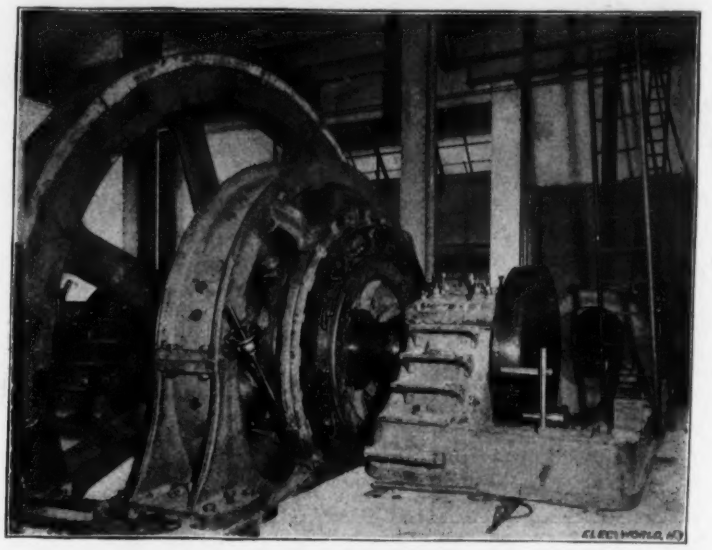
the electric conduits. In spite of these difficulties, however, the work has been rushed, many thousands of men having been at work on day and night shifts continuously since the work was undertaken last summer.

The company has had in operation for the last two years a small station at 146th Street, containing two 400-kw generators for op-



CROSSING OF MADISON AVENUE AND 116TH STREET.

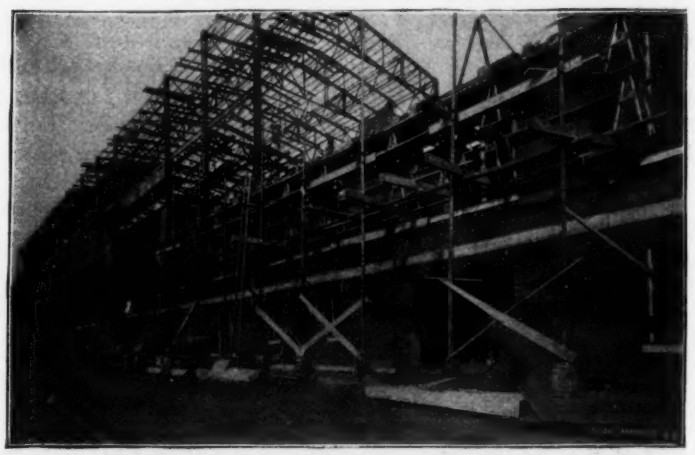
erating the conduit roads in the upper part of the city. This station has been greatly enlarged, as may be seen in the illustration. The greater part of the enlarged station will consist of a car house, several stories in height, containing repair shops, paint shops, etc., a small part being set aside for a new power station, and equipped with three 850-kw generators. These machines will be of the General Electric multipolar type, direct-coupled to cross-compound engines made by the Pennsylvania Iron Works. The cable power station on Twenty-fifth Street, near Lexington Avenue, is also being equipped with new generators of the same size, type and make. Four of these will soon be placed in this station, one of them be-



GENERATOR IN TWENTY-FIFTH STREET STATION.

ing already in running order, and another partially erected. With these two stations the system will be operated until the completion of the mammoth station now under way on the East River front, at the foot of Ninety-sixth Street.

This station, which will contain about 70,000-hp generating apparatus, will eventually supply the whole system of lines, aggregating several hundred miles in length, on Manhattan Island. Power will be generated as three-phase alternating current, probably at 6000 volts, in which form it will be distributed to sub-stations scattered over the city, where it will be stepped down and transformed

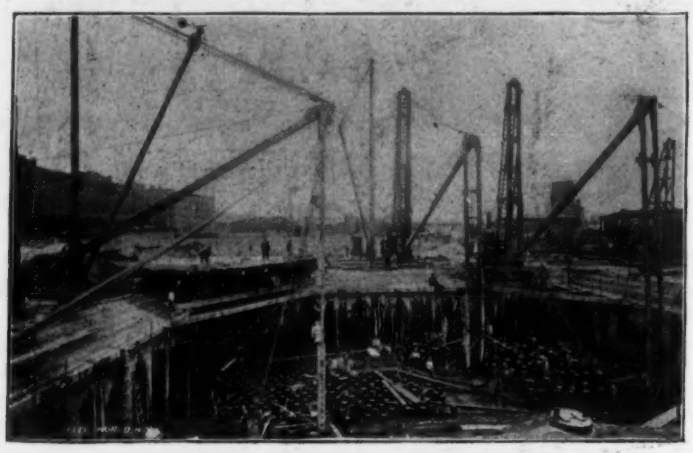


ENLARGEMENT OF POWER HOUSE ON 146TH STREET.

in rotaries to 500 volts direct current. This station will probably be completed in two years' time, and the work of transforming the present lines of the company to electric lines will be undertaken in such a manner that the temporary stations described above will be able to carry the whole load applied before the completion of the new station. The magnitude of the operations of the company can be judged from the fact that the two stations, with an aggregate capacity of some 6000 kilowatts are only considered temporary, and will probably be disposed of at the end of two years' time.

About 175 cars have already been ordered, and a large number of these have been delivered. Fifty of these are mounted on long Brill trucks and 125 on Peckham trucks. They are 28 feet long, with a seating capacity of forty-two persons, and with ten windows on each side of the car. They resemble closely in appearance the cable cars in use on Broadway and the other lines of the company. The cars are fitted with two G. E. 1000 motors, and con-

trolled with K 9 controllers. Twelve lights are distributed in the car, two of these being headlights and two platform lights, with the customary double-throw switch for illuminating either the headlight on one end and the platform light on the other, or vice versa. On the vertical frames between the windows are placed push buttons, which may be used by the passengers to signal the conductor. The circuits run to separate bells on each platform. The car equipment is virtually the same as that of the overhead



Foundation Piling of 70,000-hp Power House.

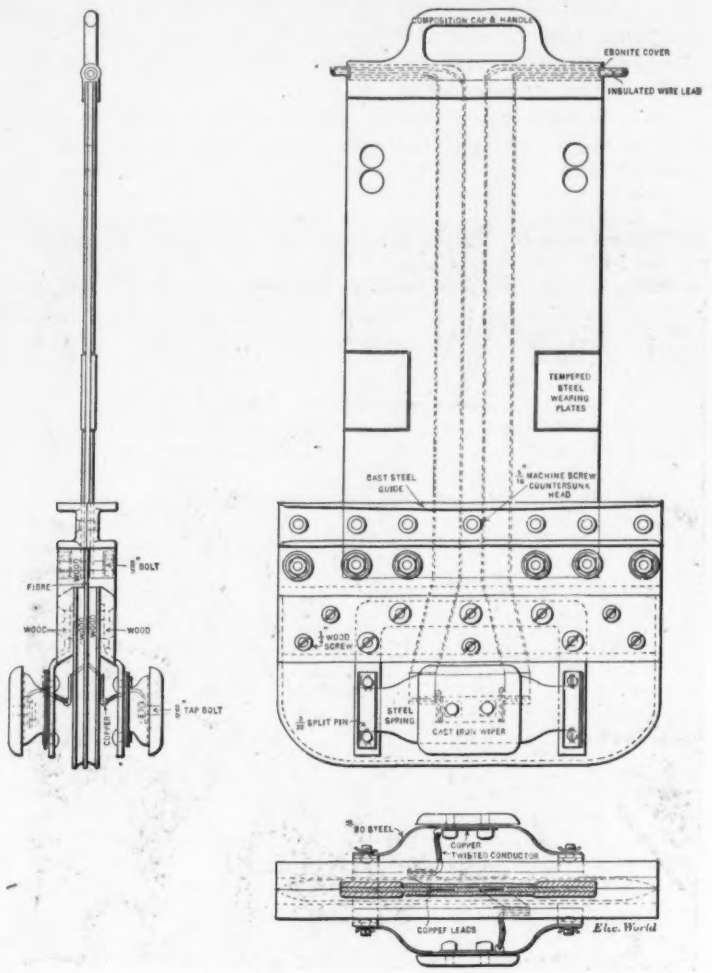
trolley cars, the main difference being the use of the plow, shown in the accompanying illustration, which is swung between the motors from cross-bars running the whole width of the car, so that the plow is free to move and follow any lateral changes that may occur in the position of the conduit. The conductors from the plow pass through two hand switches placed below the car, which are used to turn the current off from the car, as is done in the overhead construction by pulling down the trolley. The only difference other than this between the equipments of these cars and that of the overhead trolley type is that the circuit is not grounded, but is carefully kept clear of all grounded parts of the truck, and carried back through a second contact in the plow to the return rail. The plow contacts consist of cast iron wipers, which run without lubrication on the steel conductor rails.

The standard straight-line construction was described in The Electrical World in the article above referred to. The special construction at switches and crossings is very complex. Some idea of this complexity can be gained from the illustrations shown

Terminal Switches, Astor Place and Broadway.

herewith. The construction at these points consists fundamentally of concrete vaults carried under the tracks and covered by heavy steel plate roofs flush with the foot of the rail. Both tram and conduit rails at these points are 7 inches high, and the yokes are built with flush tops and with gradually widened conduits, the bottoms of which are machined to support accurately the heavy gusset posts and other special structures necessary at these points. The switches are of two types, both operated by levers. In case of entering switches, the tram and slot switch are both operated by the same lever. In certain cases of run-off switches, where it may be advisable to frequently back cars, as at terminals, etc., a similar construction is adopted.

On November 1 a short section of line between Astor Place and 42nd Street, on Fourth Avenue, a distance of about 2 miles, was formally opened, the first car passing over the line with the officers of the company, and followed by an antiquated horse car, which had been resurrected from an old storehouse, and brought out as



Details of Conduit Plow.

a curiosity. The exact age of the car was not known, but it was built about the year 1850. This section has been in continuous operation since the first of the month, with from twelve to twenty cars in use. Power is supplied by one of the 850-kw generators in the Twenty-fifth Street station, working with the high-pressure cylinder only connected, and using steam supplied by a special boiler at 45 pounds pressure to the square inch, instead of the normal pressure of 165 pounds.

Meeting of the Magnetic Club.

On Wednesday evening, November 17, the Magnetic Club held its autumn meeting and dinner at the Hotel Cadillac, Broadway and Forty-third Street, New York City. A number of delegates from out of the city who were attending the annual meeting of the Telegraphers' Mutual Benefit Association were entertained. Hon. James D. Reid, one of the pioneers of telegraphy, and for many years United States Consul at Dumfermline, Scotland, was also present. The meeting and dinner were as successful and enjoyable as usual, and much reminiscence and many bright sayings made of it an occasion to be long and pleasantly remembered.

Coming Meeting of the New York Electrical Society.

The next meeting of the New York Electrical Society, postponed from the 8th inst., will be held at Columbia University, on Monday, November 22, at 8 P. M. Dr. M. I. Pupin will give an address on "The Physics of the Ether."

DIGEST OF CURRENT TECHNICAL ELECTRICAL ARTICLES COMPILED FROM FOREIGN AND AMERICAN JOURNALS

BY

CARL HERING

DYNAMOS, MOTORS AND TRANSFORMERS.

Three Phase Motors Run with Single Phase Currents. DOBROWOLSKY. *Elek. Zeit.*, Aug. 5.—The reprint of a discussion of a recent paper by Goerges on the graphical representation of alternating potentials and their application. The present discussion, however, has nothing to do with the main subject of that paper; the paper itself has not yet been reprinted. Dobrowolsky describes a method similar to one suggested in the original paper, but for starting a three phase motor with a single phase current, exactly as though it were run with a three-phase current, except that there is a loss of energy in the auxiliary resistance; it is, however, of theoretical interest that a phase shifting can be produced in this way. The circuits in the motor are connected as a triangle or by what is known as the delta connection, and one corner is connected to one of the wires of the external circuit; the motor circuit opposite to this corner is at first disconnected; both of the other corners are connected to the other pole of the external circuit, one through a choking coil and the third corner through a resistance, the arrangement of connections resembling the diagrams of a Wheatstone bridge, in which the external circuit is the battery and the third circuit of the motor is in the place of the galvanometer circuit. By regulating the choking coil and the resistance the alternating current will be divided into two equal branches differing by 60° in phase, the third circuit is then connected and the currents in the three motor circuits will then be as though the motor were connected to a three phase circuit, the three currents and voltages being equal. Goerges stated that he found that nearly double the current was required in his arrangement for two-phase motors, and that the phase shifting was not exactly that under normal conditions; the energy consumed is therefore doubled.

Armatures with Teeth and Holes. MENGES. *Elek. Zeit.*, Oct. 28.—A long communication forming a part of the recent discussion on this subject, the other parts of which were noticed in the *Digest* within the last few months. He agrees with Du Bois (see *Digest*, Sept. 11), but believes that the principal point was not considered by the latter. He discusses the action of the wire in the various kinds of armatures with and without teeth and holes, and shows that in an armature with holes the action is identical with that in a much larger armature without holes or teeth, as far as the active wires are concerned, but that this applies also to the hole armature when the holes are cut open, making teeth; the object of the slots is therefore to bring those wires, when not in the active part of the field, that is, when in the commutating position, into the same favorable condition as the windings of a smooth armature, without losing the advantages of the armature with holes when the wires are in the active position.

Forms of Field Magnets. BAXTER. *Amer. Mach.*, Nov. 11.—An article giving illustrated descriptions of the various forms of such magnets and describing their influence on the efficiency of generators and motors.

LIGHTS AND LIGHTING.

Electric Arc. CLAUDE. Lond. *Elec.*, Oct. 23.—He discusses the possible increase of light efficiency of the arc and the experiments of Wilson with the arc under pressure. The light efficiency of the arc increases rapidly with the temperature, which is said to be limited by the boiling temperature of carbon; if a conducting substance of a higher boiling point could be found the temperature would be much greater, but such a substance is not known; it is possible that some such substance might be formed in the electric furnace, as, for instance, a carbide or a silicide; it frequently happens that the combination of two materials fuses at a higher temperature than either of the two constituents. The boiling temperature of a body increases with the pressure, but the experiments of Wilson gave contrary results; he endeavors to show how it is possible that the results of Wilson may not necessarily lead to that conclusion. He discusses recent experiments of Villard, who succeeded in dissolving in a gas quite appreciable quantities of certain solid substances, the quantities increasing rapidly with the pressure, and it is believed that some such phenomena may have taken place in the experiments of Wilson, that is, that there may be a solution of carbon in the atmosphere, which gave the results obtained by Wilson; it may also be that the limitation of the temperature is due to other causes than the temperature of the boiling point; the subject of the temperature of the arc under pressure ought therefore to be further investigated; if it is possible to increase the temperature with pressure different reactions might be obtained in the electric furnace to advantage.

Errata.—In the *Digest*, Nov. 6, the abstracts of three articles on the electric arc were by an unfortunate mistake placed under the division heading "Miscellaneous," instead of under "Lights and Lighting," where they belonged.

POWER.

Water-Power Plant.—Eng. News, Nov. 4.—A note stating that a small plant is being used by a company in India for operating all machinery for handling the growth of 3000 acres of tea land. About 30 horse-power is transmitted from a water-power to the factory about a mile distant at 320 volts, where it drives a single motor.

TRACTION.

Accumulators on Electric Carriages. E. H. *L'Ind. Elec.*, Oct. 25.—A short article on the best weight of accumulators to be used; this problem has already been solved in practice, and he shows that practice and theory lead to the same result. The object is to find the relative weight of the accumulators which will give the best results between the two limits, 0 per cent. and 100 per cent. Under normal condition at a given speed the distance should be as great as possible over which the greatest possible useful weight is carried. He assumes a weight of 1 ton including everything; on a good level road the coefficient of traction will not exceed 0.025 and the traction effort will therefore be 25 kg m.; at a speed of 18 km (10.8 miles) per hour the power will be 125 kg per second; at an efficiency of 70 per cent. the accumulators must furnish 1800 watts; from this it follows that 100 watt hours are required per ton km, a figure which was confirmed experimentally by Morris and Salom. In another type of accumulator there is a minimum weight below which traction on the level at a given speed is impossible; accumulators are now made which will give 10 watts per kg of total weight or 20 watt hours per kg; by increasing the weight of the accumulators the distance is increased but the remaining weight allowed for the passengers is reduced; the theoretical limit is when the accumulator would only just carry itself, in which case the useful weight would be zero. To show how these factors are connected with each other he constructs a diagram, the abscissæ of which represent the weight of the accumulators between 0 and 1000 kg; the useful weight is the difference between the total and the weight of the accumulators, and this is represented by a 45° diagonal in the curves given; the distance in km based on 20 watt hours per kg of accumulators is a similar diagonal at right angles to the other; what he terms the utilization of the accumulators is represented by the product of the distance covered and the useful weight carried, expressed in ton-km, and this is represented by a curve somewhat resembling a sine curve or parabola with a vertical axis, the upper maximum passing through the centre of the diagram where the two diagonals intersect, and the two lower ends ending in the corners of the diagram; this curve of utilization shows that in no case should the weight of accumulators be greater than 50 per cent of the total, because from that point on the utilization diminishes and the difficulties in constructing a light carriage increase; on the other hand it is difficult to diminish it below 25 per cent., as the distance will be too small. These conclusions are confirmed by practice; those in use carry between 30 and 40 per cent of their total weight in accumulators, which corresponds to a distance on the level of between 60 to 80 km (10.8 miles) per hour under the other conditions given above. He concludes that for a speed of 28 km per hour on the level and for a certain distance to be run, an expenditure of 100 watt hours per ton-km and a specific power of 1800 watts per ton are required; with present accumulators it requires about 5 kg for storing 100 watt hours and 300 kg for drawing a ton at the speed indicated. These figures suffice for determining the weight of accumulators necessary for any particular case; for running longer, farther, or faster, further progress in accumulators is necessary.

New Form of Controller. BLONDEL. *Elek. Zeit.*, Oct. 28.—An illustrated description of a new form of controller which he has devised. Recently a number of articles were published showing the advantages and disadvantages of shunt wound motors for traction purposes, and it was generally conceded that in a number of respects the shunt motors would be better, as they maintained a constant speed and enabled the energy to be recovered in going down hill; the series motors on the other hand have the advantage of a much simpler construction and of having the current regulated automatically. In this new system the advantages of the shunt motor may be had by a series motor without losing the good features of the latter; this is accomplished by means of a current from an accumulator which, on the car, is suitably combined with the main current; with this arrangement it is not only possible to break with the motors, but also

to get the energy back again and obtain a gradual series of points. There are two motors and an accumulator battery besides a special form of series parallel controller consisting of two cylinders, one for regulating the speed and the other for reversing the direction; the battery is divided into two groups, which can be connected with the exciting coils of the two motors; these two batteries are connected with the motor exactly like the resistances which are generally used for connecting to the exciting coils as shunts, to weaken their magnetism for an increase of speed; it is therefore possible to use the present form of series parallel controller without any changes, and merely to add some sliding contacts to the cylinder which determines the direction of motion; better results are obtained, however, if some alterations are made in the controller cylinder. Two of these arrangements are fully described by means of diagrams showing the circuits for each position of the controller. They show that the accumulators never have to carry a very strong current, as they are only used after the car is started; a small battery would therefore suffice, as it is only for the excitation of the magnets; for instance, for a 2-hp motor a battery of 16 volts and 20 amperes, weighing 120 to 160-kg will suffice. This is specially applicable to accumulator cars, as it enables the volts to be regulated automatically, which is not possible by the method of separate excitation; in place of the accumulators a small motor generator may be used with two generating armatures; an illustration is given of the application of the method to a locomotive. The method is particularly applicable to locomotives.

Shunt Railway Motors. Bauch. *L'Ind. Elec.*, Oct. 25.—A translation of his German article which was one of the two noticed in the *Digest*, June 19; he describes his own system, in which he claims that shunt motors can be applied in practice.

Accumulator Traction in Cologne. Biggs. *Elec'ty*, Nov. 10.—A reprint of the article noticed in the *Digest*, Nov. 13.

Electric Railroad Appliances.—Railroad Gaz., Oct. 15.—Extracts from letters from a number of dealers in street railroad supplies, including numerous illustrated descriptions of various railroad accessories.

Meeting of the Street Railway Association.—St. Ry. Jour., Nov., *St. Ry. Rev.*, Nov. 15.—Reprints in full of all of the papers, discussions and proceedings at this meeting.

Convention of the St. Ry. Accountants' Association.—St. Ry. Jour., Nov.; *St. Ry. Rev.*, Nov. 15.—Accounts of the proceedings of the recent meeting and reprints of papers. The former journal also contains some notes and comments on this convention by Kittredge.

INSTALLATIONS, SYSTEMS AND APPLIANCES.

Increasing the Efficiency of Transformer Distribution.—L'Ind. Elec., Oct. 25.—A well-illustrated description of the Schlatter cut-out for transformers which has been in successful use for a year and a half (presumably in Budapest); the objects of this cut-out are to automatically switch the transformer out of circuit when there is no load on the secondary and vice versa; also in case of a number of transformers in multiple, to cut out one after the other as the load diminishes, and vice versa. In the first part of the article attention is called to the losses in transformer transmissions, due to the permanent losses in the transformer; practice has shown that the daily output of a central station is approximately equal to that at full load for two hours; on this basis he calculates the daily efficiency of transformers of various sizes, which are as follows: 10 kw., 75 per cent.; 5 kw., 69.2 per cent.; 2.5 kw., 65 2 per cent.; 1 kw., 51.5 per cent.; the calculations are based on results obtained in practice. He concludes that the only way to increase this efficiency is by some system of transformer cut-outs. Good diagrams of views of the apparatus are given; the principle is based on the use of a very small auxiliary transformer, the primaries and secondaries of which are in series with the corresponding ones of the large one; the transformer is not entirely out of circuit with no load, but the losses are reduced 95 per cent., and the remaining loss is almost entirely in the small transformer, which contains very little iron, and in which the winding is such that the largest part of the power at no-load is absorbed by the smaller transformer; the circuits are connected with magnets, levers and mercury cup switches, with the aid also of an intermediate secondary terminal from the large transformer; when the first lamp is switched on the current furnished by the two transformers in series is sufficient to operate the switch.

Distribution of Electrical Energy in Paris. Laffargue. *L'Ind. Elec.*, Oct. 25.—A long abstract of the recent official report of Bos to the municipal authorities; it is chiefly of local interest and contains data concerning the stations. It shows the need of a municipal service, and control of the companies; the condition of the companies does not seem to be satisfactory; the cost of the electrical energy is too high and electric lighting is therefore not sufficiently developed; to reduce the price the system should be extended and this could not be done unless the franchises be prolonged.

Electric Light Plant for Small Towns. Dow. *Elec. Eng'ing*, Nov. 1.—The conclusion of his serial (see *Digest*, Oct. 9.) He gives directions to engineers showing how they should proceed to take charge of the construction of an electric light plant for a small town.

Care of Alternating Current Machinery. Baxter. *Power*, Nov.—A continuation of his serial of practical articles giving hints on the care of electrical machinery.

WIRES, WIRING AND CONDUITS.

Protection Against Dangers of High-Tension Distribution. Claude. *L'Elec.*, Oct. 30.—A short article, in which he calls attention to some points in the recent rules published in Germany, claiming that they are too brief and superficial in some cases. It is stated that high-tension lines should be so constructed that accidental contact by persons should be impossible or without danger, but how to do this is not described; with the continuous current this is possible, but with the alternating current, even though the circuit may be perfectly insulated, the contact with one wire by a person standing on the earth is nearly as dangerous as though he touched both of them. He calls attention to a remedy, or rather a palliative, which he described in 1893, and which consists simply in neutralizing the capacity, which causes this effect, by connecting the two wires with a self-induction coil, the middle of which is connected to the earth; it appears that this applies only to those cables which are not concentric; this greatly increases the apparent resistance of the insulation; it is not possible to thus exactly neutralize the capacity nor to obtain an apparent infinite insulation resistance; but in case of accident the chief current is stopped, and only that portion passes through the body of which the voltage is much less than that of the principal current; in other words, it practically multiplies the apparent insulation four to five times.

Poles and Supports for Wires. Montpellier. *L'Elec.*, Aug. 14, Sept. 11 and 18 Oct. 2 and 30.—A continuation of his long serial, which is a sort of treatise on poles and supports for overhead wires, and includes many illustrations.

Wiring Accessories. Hundhausen. *L'Elec.*, Oct. 23 and 30.—The conclusion of the translation noticed in the *Digest*, Nov. 6. It is very fully illustrated with forty-eight illustrations of the various fittings.

Replacing Insulators on a 10,000-Volt Live Circuit. Jackson. *Elec. Rev.*, Nov. 10.—A brief account of the method which he uses for changing the insulators on a 10,000 volt circuit while the current is on the line, by a method which is quite safe. He uses a ladder made in two parts, so that its length can be changed to just reach from the ground to the cross-arm; the lower end rests on a small platform which is supported on four insulators, so that the ladder is perfectly insulated; the upper part rests on the cross-arm. The operator mounts the ladder and screws a hand vise in the cross-arm, attaches a wire to this and touches it to the line wire; if everything is all right a temporary connection is made; after the temporary grounding of the wire the man proceeds with bare hands to change the insulators, after which the ground wire is again taken off. His plant runs night and day, and it has not been necessary to take the current off the line for the past two and one-half months. (He does not say what he would do should there be two moderately high resistance faults in the insulators, that is, in case the above-described grounding test did not show that everything was "all right.")

Capacity of a Cable. Patterson. *Science*, Oct. 29.—A reprint of a formula from his recent A. A. A. S. paper on the electrostatic capacity of a two-wire cable; the formula is not very complicated.

ELECTRO-PHYSICS AND MAGNETISM.

Electric Field of the Atmosphere. Le Cadet. *L'Elec.*, Oct. 23; *L'Ind. Elec.*, Oct. 25.—A reprint of an Academy note giving the results of his recent balloon ascension, Sept. 11, in which he measured the electric field of the atmosphere at various heights; he used the same apparatus as on his previous ascensions; some of these results are given; they lead him to the conclusion that in those altitudes the intensity of the electric field of the atmosphere diminishes as the height above the surface of the earth increases; this diminution is generally quite rapid in the first kilometer, less so in the second, and very slight in the third and fourth; it becomes zero at a height of probably 800 meters.

Viscosity of Insulating Liquids in an Electric Field. Quincke. *Elek. Zeit.*, Oct. 21; abstracted from the *Wied. Ann.*, 62, p. 1.—He found that insulating liquids when placed in a constant electric field, that is, under dielectric polarization, have a greater viscosity than under normal conditions; he also determined the laws of this increase in the direction perpendicular to the lines of force and parallel to the lines of force, the latter being "1.5 to 6 times smaller."

Mechanics of Electrical Phenomena. Britt; Weyde. *Elek. Zeit.*, Oct. 28.—Two communications, one by the former in which he criticises the recent article by the latter (see *Digest*, Oct. 2); he shows that certain actions cannot take place, and that certain assumptions are incorrect; he then offers a different and simpler explanation of the phenomena of electromagnetic induction and thermo electricity, based on the theory of the rotating cells. The communication by the latter is a reply to this criticism; it consists partly in a further explanation, with an illustration, of a point which was not made clear.

Tail of Comets.—L'Ind. Elec., Oct. 25.—A brief notice of a recent article by Goldstein, a German astronomer. It is known that when a solid body is in the track of cathode rays in a vacuum tube it becomes a secondary source of such rays, which are repelled by the primary rays; according to Goldstein's theory the sun is a source of primary cathode rays; the gase-

ous nucleus of comets is a secondary source which produces rays in the opposite direction to that from the sun on account of the repelling action, and this beam of rays is supposed to be the one which produces the comet's tail. He has succeeded in reproducing these phenomena in vacuum tubes. He thinks this theory has a more general application, and explains magnetic storms, earth currents, the aurora borealis and even the ordinary storms.

Haziness in Radiographs. CHABAUD. *L'Ind. Elec.*, Oct. 25.—The conclusions from an Academy note. Beginning with a certain fixed resistance both electrodes in the tube give off cathode rays, which results in their being two sources; at that same resistance the tube emits X-rays in every direction; a "hard" tube requires longer exposures than a "soft" one, but gives much more hazy radiographs and much less sharp than from the latter; a large tube with large electrodes gives a greater luminosity than a small one, but not so sharp an image.

Magnetic After-Effect. KLEMENCIC. *Elek. Zeit.*, Oct. 21; abstracted very briefly from the *Wiener Ber.*, March.—By after-effect he means the property that long wires of soft iron in a magnetic field do not acquire the full magnetism at once after excitation. His researches show that this after-effect takes place chiefly only in weak fields, and it diminishes with the strength of the field, the more rapidly the smaller the diameter of the wire; he could find no fixed law; the action is temporary and is strongest immediately after annealing, after which it diminishes.

Steinmetz's Exponent. WEILER. *Elek. Zeit.*, Oct. 28.—A short communication in which he calls attention to the fact that what is known as Steinmetz's exponent (1.6 in the formula for determining the loss of energy due to magnetic hysteresis) is the same as the exponent in the expression for calculating the relation between the coefficient of friction of mercury vapor and the temperature. He believes that this is not accidental, and suggests that there may be some similarity between the laws governing the molecules in the two cases.

Discharge of Electrified Bodies by X-Rays. CHILD. *Phys. Rev.*, Oct.—The first part of a long article, which appears to be the same or similar to the one read at the Detroit meeting of the A. A. A. S. He begins with a review of the articles which have been published on this subject, giving references to them all, and then proceeds to describe his researches, in which he experimented chiefly with the influence of the pressure of the gas, and finds that when it is increased from a few millimetres of mercury to atmospheric pressure the rate at which electricity can be conducted by the air in general increases to a maximum and then decreases again; the pressure for the greatest conductivity of the air depends on the E. M. F., and, if high, the pressure for maximum conductivity seems to be greatly in excess of the atmospheric pressure, and lies beyond the range of his measurements. He also investigated a number of other points, some of which have been in dispute; he finds, for instance, that a continuous discharge can take place even when the body is covered with a solid insulator, such as a layer of paraffin. It is thought that his experiments will go far toward explaining the irregular and contradictory results which most observers have obtained.

Electric Properties of Fumes.—El'ty, Nov 10.—A reprint of the abstract noticed in the *Digest* last week.

Electric Waves. HULL. *Phys. Rev.*, Oct.—A long article on the use of the interferometer in the study of electric waves; researches are described and conclusions drawn therefrom.

British Association Meeting at Toronto. MARTIN. *Pop. Science Mo.*, Nov.—An article giving the impressions of an American member who attended the meeting; it is a series of general notes rather than a record of the papers and proceedings.

Meeting of the American Association for the Advancement of Science.—PATTERSON. *Science*, Oct. 29.—An account of the papers on physics at the Detroit meeting, brief abstracts of the papers being given; some of these papers have already appeared before in THE ELECTRICAL WORLD, and some abstracts were noticed in the *Digest*.

ELECTRO-CHEMISTRY AND BATTERIES.

Bleaching by the Electrolysis of Sulphites. ANDREOLI. *L'Elec.*, Oct. 23.—A short article describing the ordinary process of bleaching linen in a solution of sulphite of soda and sulphuric acid, and the subsequent elimination of the acid by chalk, peroxide of hydrogen, or ozone, the two latter being much better; the bi-sulphite is generally preferred to the sulphite; the "hydro-sulphite" is also used. The bleaching liquid is usually prepared with the aid of zinc, and the substitution of electrolysis for zinc therefore suggests itself, but great difficulties are involved; he discusses this question and describes the Villon process, in which "hydro-sulphite" of soda or ammonia is produced by a single operation transforming all of the sulphite into hydro-sulphite, while with the zinc only one-third is so converted. The bi-sulphite is electrolyzed in a porous cup; with 12 horse-power during twenty-four hours 300 liters of the saturated hydro-sulphite is obtained, the bleaching property of which is 3.5 times that of the hydro-sulphite produced by zinc; the electrodes appear to be carbon or gold-plated copper; the liquid around the anode is sulphuric acid in a 10 per cent. solution; the cathode is in a solution of bisulphite of soda at 35° B. and the liquids are cooled down to 0° C.; the vessel is hermetically sealed; in six hours the solution can bleach 100 kg of linen at a cost of $1, while the analogous non-electrical process costs $2 70. The liquid is regenerated by simply repeating the process, and the cost is then only 40 cents per 100 kg of linen. He adds that there is a great difference between this electrolytic process in the laboratory and its industrial application, and he believes that it has never yet been used.

Purification of Sewage by Electrolysis. E. A. *L'Elec.*, Oct. 23.—A note on the recent negative results obtained at Bombay in the purification of sewage by electrolytically produced hypo-chlorite of soda. There is no doubt that electrolyzed sea water will produce some effects, but these effects have neutralized its deodorizing power, and the amount of chlorine is not in proportion with the great contamination of the sewage and the rapidity with which the water circulates. The maximum quantity of chlorine was 2 kg per hour, which is only one gram per 500 liters of the sewage, and he states that little can be expected from this; no such experiments in which there is no hope for success should have been tried; the installation is not proportionate to the quantity of sewage to be treated.

Glass Covered Electrolytically with Metal.—Eng. News, Nov. 4.—A note stating that metal frames are now being made around prismatic glass used for windows. The glass sections are mounted in frames of the desired shape formed of thin ribbons or wires and submerged in a bath; in this the metal is deposited on them until a complete frame is formed, firmly binding the glass in place.

Electro-Chemical and Metallurgical Industries of Europe. KERSHAW. *El'ty*, Oct. 6, 13 and Nov. 10.—A continuation of his long serial. The present instalments cover the Kellner bleaching processes, calcium carbide, acetylene gas, industrial and patent notes on electrolytic soda and bleach.

UNITS, MEASUREMENTS AND INSTRUMENTS.

Voltage of Induction Coils. OBERBECK. *Wied. Ann.*, No. 62, p. 109; abstracted in the *Elek. Zeit.*, Oct. 21.—A longer abstract, with the illustrations, of the article noticed in the *Digest*, Oct. 16. He also confirmed the known fact that the maximum voltage is higher the slower the interruptions in the primary, or the longer the primary circuit was closed before the break takes place. From these results it appears that with a voltage of 60,000 under certain conditions a stream of sparks of more than 10 cm (4 inches) can be obtained.

Measuring the Frequency of Oscillations. MARGARET MALTBY. *Science*, Oct 29.—A very brief abstract of her A. A. A. S. paper describing a method for measuring the period of electrical oscillations based on a new application of the Wheatstone bridge principle. The two halves of the measuring instrument, which is an electrometer, form two arms of the bridge, and the other two contain a condenser joined to the electrometer needle and to the two pairs of quadrants respectively; the relation that exists between these two when there is no deflection is a function of the rate of alternations of the current that passes through the system. It appears that a similar description was given in the *Wied. Ann.*, 61, p. 553.

Cadmium Standard Cell. JAEGER. *El'ty*, Nov. 10.—A reprint of the translation noticed in the *Digest*, Nov. 13.

TELEGRAPHY, TELEPHONY AND SIGNALS.

Telephone Statistics for 1895.—Elek. Zeit., Oct. 28.—An abstract, including a large table of statistics for Europe, Asia, etc., from the annual statistics published in the *Journal Télégraphique*, giving the number of telephone central stations, the length of lines, the interurban lines, number of subscribers, communications, etc.; a number of the important countries of Europe are not included; no general summary is given. In an editorial in the same issue some interesting comparative statistics are given; they are based on the above, with some of the omissions supplied; they are in the order of the number of inhabitants per telephone, and this order of the countries proves to be the same as it was in the corresponding statistics for the previous year. In Germany the interurban communications are much more numerous than in any of the other countries; in proportion to the population there are in Germany 0.88, in Switzerland 0.73, and in Sweden 0.47 communications per inhabitant per year.

Apparatus for Indicating a Repaired Fault. DEHMS. *Elek. Zeit.*, Oct. 28.—When a broken or faulty telegraph line has been repaired, a loss of time takes place before the operators know that the repair has been completed. In the present article he describes several methods by which each of the end stations is signaled as soon as the line has been repaired; a bell is caused to ring at both stations.

Telephone Transmitters. WEITLISBACH. *Elec. Eng'ing*, Nov. 15.—A very brief continuation of his long serial in that journal, the publication of which was temporarily suspended for some time, but it will now be continued; it is a sort of treatise on the subject of telephony.

Microphone Litigation.—Elec. Eng'ing, Nov. 15.—A summary of the proceedings leading up to the present situation in the case of the pending suit against the National Telephone Company in Massachusetts, which suit may shortly be decided.

Marconi Telegraph.—El'ty, Nov. 10.—A reprint of the article from the Lond. *Elec. Rev.* Oct. 8, noticed in the *Digest*, Oct. 23.

Time Service in England.—El'ty, Nov. 10.—A reprint of a short article. from Lond. *Lightning* describing an improved synchronous clock system

MISCELLANEOUS.

Biographical.—Lond. *El'ty*, Oct. 29.—With this, the annual special issue of that journal, there is published a supplement containing portraits and brief biographies of seventeen municipal engineers in Great Britain; a few of these are known in this country by articles which they have written.

Electric Steering Gear.—El'ty, Nov. 10.—A reprint of a translation giving a brief description of the electric steering gear on one of the German war ships, which was noticed in the *Digest*, some time ago.

A New Type of Car Controller.

The Walker Company, Cleveland, Ohio, has placed upon the market a new type of car controller, embodying some departures from customary practice, of considerable note. The chief change in this controller from previous types is the form of blow-out, which is called a solenoid blow-out, to distinguish it from what is known as the magnetic blow-out in other types. As the name

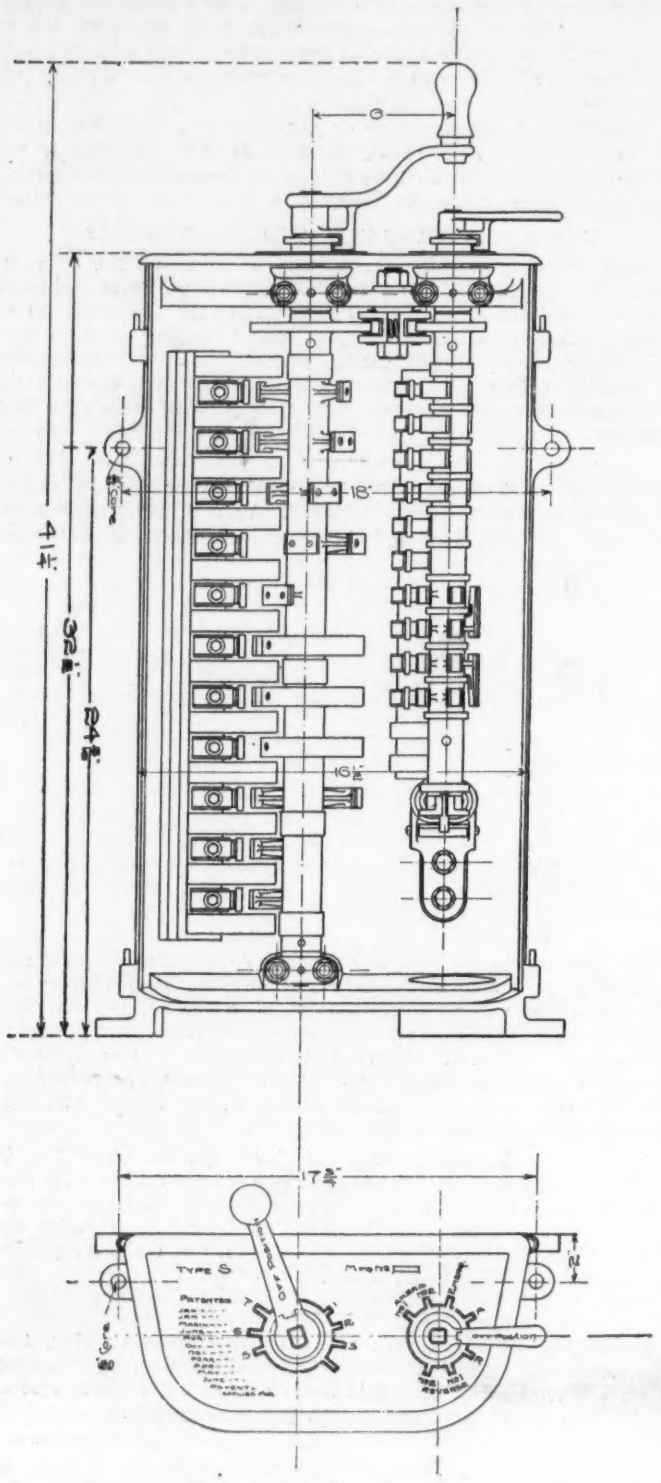


DIAGRAM OF CONTROLLER.

indicates, the blow-out is effected magnetically, but without the use of any iron to carry the lines of force. The blowing-out solenoid consists of an insulated copper ribbon wound spirally into the form of a disc, about 3 inches in diameter, and three-eighths of an inch in thickness. This disc is imbedded in the vulcabeston partition placed between the contact fingers of the controller. All the solenoids throughout the entire length of the controller are connected up in series. The opening in the centre of the spirally wound disc is placed just opposite the contact of the finger with the cylinder, so that the magnetic field generated by the solenoid shall act properly on the arc. The action differs radically from that of previous types in that the lines of force tend to lift the arc straight out from the cylinder instead of blowing it axially against the insulating partition and burning the latter at every opening.

Another valuable feature of the solenoid is the absence of the iron pole tips, which always involve the danger of grounding if the arc is particularly vicious and jumps to them. The claim is also made that the solenoid blows out the arc more smoothly than the iron-cored magnet, the effect of the latter being a sudden disruption of the circuit, which produces dangerously high voltages in the self-inductive windings of the motor. The solenoid, on the contrary, seems to ease down the current in the arc and to blow out quietly. The solenoids are not kept in circuit constantly, but are cut in circuit at the instant when they are wanted and cut out immediately afterward by a short-circuiting finger and suitable contacts.

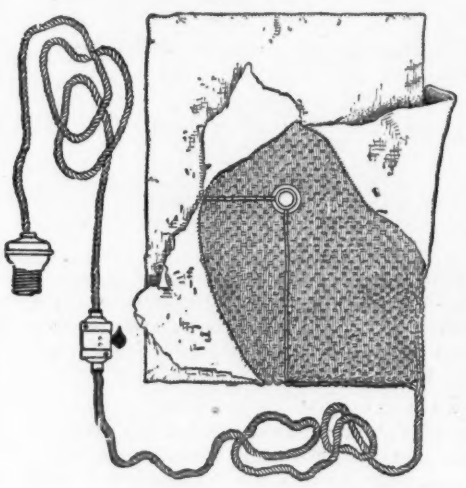
The new controller is fitted with the seven-point reversing switch, which is of great convenience in cutting out motors. Beside the ordinary positions for running both motors forward and both motors backward, the other five points provide for various emergencies. Two of the points run No. 1 motor alone, backward and forward; two others run No. 2 motor in either direction, and the seventh notch applies an emergency brake by short-circuiting the motors through a portion of the rheostat. This takes the place of reversing the motors in case of accidents and applies a heavy retardation to the car with much less risk to the apparatus. The controller is fitted with a magnetic locking device, which will not allow the emergency brake to be released until the car comes to a standstill. The emergency notch is so fixed that an extra effort is necessary on the part of the motorman to use it, thus preventing accidental braking. Neither the controlling handle nor the reversing handle can be removed from their respective positions, except n the off position; nor can the former be turned unless the latter is in the proper position.

The new controller is remarkably light considering the power it is intended to control. Each instrument for a 25-hp equipment weighs 200 pounds, the rheostat for such equipment weighing 90 pounds more.

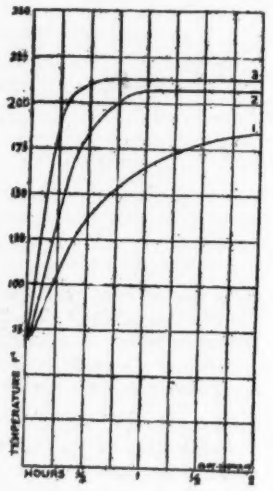
Improved Electrotherm.

The electric heating pad, which was first brought out by the H. W. Johns Manufacturing Company, New York, about two years ago, has undergone some important improvements since that time, and the slight deficiencies that were developed in the original form by practical use have been entirely and successfully met. The electrotherm now seems to be a practically perfect device to accomplish the object for which it is manufactured, namely, the local application of heat to the body in the treatment of disease.

The electric-heating pad offers many obvious and important advantages over the time-honored hot water bag. The principal objection to the latter is that it cools with comparative rapidity, while the electric heating pad receives a



ELECTRIC HEATING PAD AND THERMOSTAT.



TEMPERATURE CURVES.

constant and uniform supply of heat, thus meeting the greatest objection to the hot-water bag. The electrical method offers a further advantage in that the temperature may be raised gently and the patient spared the discomfort and the shock of the sudden application of the hot-water bag at its highest temperature.

The conductor forming the resistance or heating wire of these pads is covered by asbestos, and thus thoroughly insulated and protected. It is then woven into a cloth or pad about 11 x 15 inches and ¼ inch thick. The arrangement of the circuits is such that by means of a simple regulating switch (shown on the lamp cord in the illustration), three degrees of heat may be obtained by means of the key. The cord is also provided with a connecting plug for attachment to an ordinary incandescent lamp or wall socket. The

amount of electrical energy required to heat the pad is the same as that required for a 16-cp lamp, or about 66 watts. The regulator is marked with four positions of the key, 0, 1, 2, 3. At the 0 point the current is entirely turned off.

These pads are now provided with a thermostat or temperature regulator, which is constructed in the form of a button and placed in the centre of the pad, as shown in the accompanying illustration. It was found necessary to introduce a thermostat device in order to avoid excessive heat, which may result under abnormal conditions and become unnecessarily severe for both the patient and surroundings. By the introduction of the thermostat all such risk is practically obviated. The thermostat is a very compact device and has been thoroughly tested as to its durability and its reliability of action. Tests were conducted over a period of several weeks, and they demonstrated that the variations in the readings of the temperature averaged between 10 degrees F. above, and 10 degrees F. below the rated temperatures for which the thermostat was set. These tests are only of value in that they show the longevity of the thermostat, which probably operated 8000 times during the test. To meet average conditions of use the setting of the thermostats at 213 degrees has been found to furnish temperatures suitable and convenient for the usual applications.

The accompanying diagram shows the average temperatures obtained in given times with the electrotherm completely covered with blankets, which represents nearly actual conditions of ordinary use. The thermostat was in each case set to operate at 213 degrees F.

As regards the thermostat itself, it is a circular device, about seven-eighths of an inch in diameter and one-eighth of an inch in depth. It is dish-shaped, and so substantially constructed that a heavy person may walk upon it without injuring it in the least. The temperature point of action is regulated by a regulating screw provided for the purpose.

The electric-heating pads, or electrotherms, as they are termed, by the manufacturers, are obtainable with felt and rubber covers, as may be desired, for dry and moist heat, respectively. The rubber-covered pads are made as large as from 18 to 24 inches wide, and up to 6 feet in length.

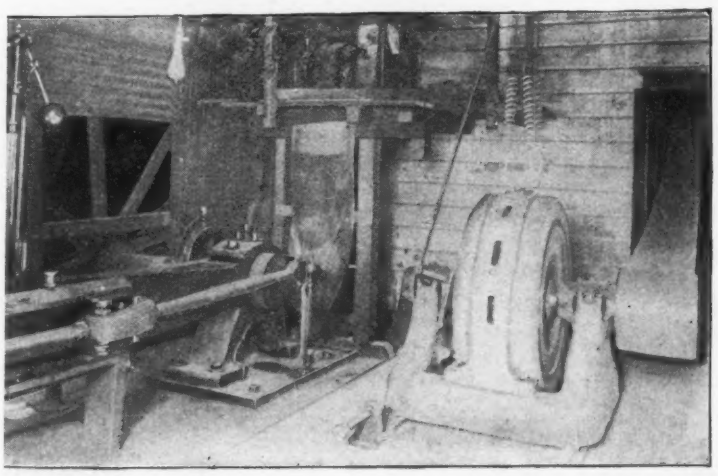
Electric Power in Flour Mills.

Since the completion of the great three-phase electric power transmissions on the Pacific Coast, between Folsom and Sacramento, and the San Joaquin and Fresno, the use of electricity as a motive power has made great strides. Two of the most important flour mills are now added to the already long list of consumers.

The first to place its dependence on electric motors instead of the steam engine was the Sperry flour mill of Fresno. This is driven by a General Electric synchronous motor of 150-kw capacity, running at 600 revolutions. The illustration shows this motor with a small bipolar motor to bring it up to speed, in the basement of the mill, whence the main belt passes to the rolling and grinding machinery above.

The second mill is the second in importance on the Pacific Coast, and the largest flour mill in the United States using electricity instead of steam. Its electrical equipment consists of three General Electric three-phase alternating current induction motors, operating at a pressure of 500 volts. The largest of the three motors has a capacity of 75 horse-power. This is belted to the main shaft of the mill, and drives all the flour-making machinery. It runs continuously for twenty-four hours, and for three months without stop. The second largest motor is one of 30 horse-power. This occupies a position on the second floor of the mill, and drives all the cleaning machinery. It runs continuously for eighteen hours daily. The third is a 20-hp motor, and is placed in the basement near the 75-hp motor. This drives the roll for grinding the corn and the barley. Its work is intermittent, and it runs from eight to ten hours per day only.

The power consumed by the motors is registered by means of recording meters, which show the total horse-power of current consumed. When the cleaning for the day is completed and the 30-hp motor and all the cleaning machinery are shut down, all expenses for power in that department cease at once. No power is wasted in running idle shafting and belting. The same is

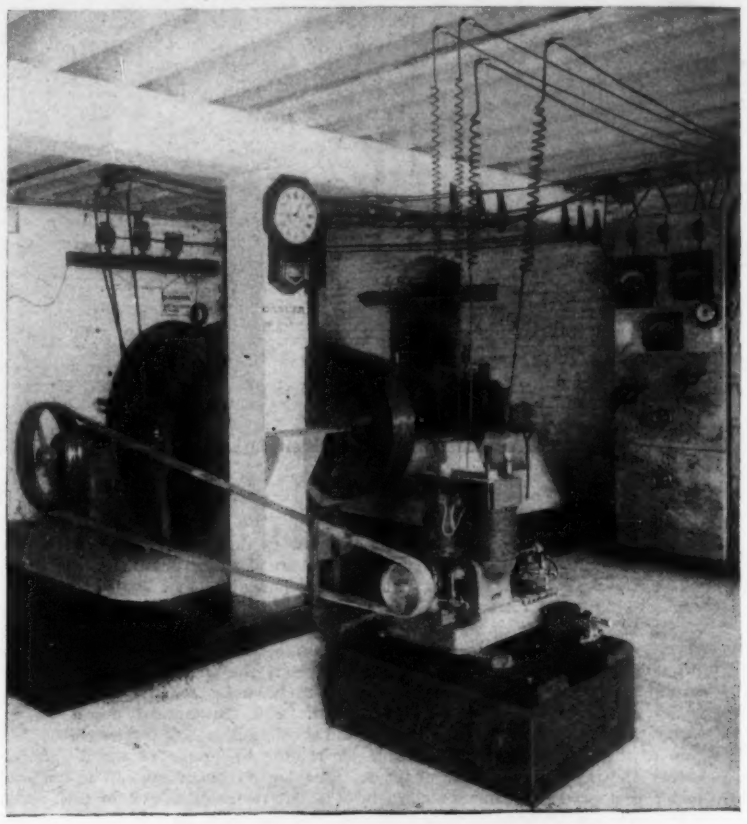


75-HP INDUCTION MOTOR IN PHŒNIX MILL.

true in a still greater degree in the corn and barley crushing department, where the work is more intermittent.

Still another source of saving lies in the fact that neither engineer nor fireman is required to operate the mill electrically. The motors are so simple in their operation that any employee about the mill can handle them. It is estimated that the economy in actual power consumed in the Phœnix Mill by the present method of driving is not less than 15 per cent., and the total saving in the entire cost of operation will pay for the electric motors, their installation and adaptation, in less than one year.

In addition to the economy in the operation of the mill by the introduction of electricity as the motive power, a considerable amount of space has also been saved, as will readily be realized, and the room formerly occupied by the driving machinery can now be utilized for another machinery or for storage purposes. The present capacity of the Phœnix Mill is 275 barrels of flour and 20 tons of rolled barley and feed every twenty-four hours, and the entire output of this mill is taken by local consumption, none of the product being shipped outside the State. It was due to the careful investigation of the subject by Mr. J. H. Arnold, the manager, that electricity was adopted as a motive power.



150-KW SYNCHRONOUS MOTOR IN SPERRY MILL.

A New Type of Electric Meter.

Electric meters for use in the premises of patrons of an electricity supply station usually consist of some form of integrating ammeter or wattmeter, the one being the equivalent of the other, if the system of supply is at constant voltage. The instruments now in general use for this purpose fulfill the requirements admirably, but on account of the delicacy of their structure and the nicety of their adjustment, their price is necessarily high. It has been for a long time a desideratum to produce a type of meter which could be built cheaply and constructed somewhat after the method employed in making cheap clocks, that is to say, of stampings and other machine-made pieces in large

VIEW IN EXPERIMENTAL METER SHOP.

Calibrating the Working Parts of the Meters.

part, so that the cost could be brought down to the reasonable figure necessary in order to assure the general introduction of the instruments.

The American Electric Meter Company, Philadelphia, Pa., has just brought out some types of meters of a novel design, which are adapted for two and three-wire circuits at 110 and 220 volts, as ordinarily supplied for incandescent lighting and motor purposes. These meters, which were designed by Prof. William D. Marks, consist of an amperemeter, the indication of which determines the movement of an escapement operated by a pendulum, which is isochronously driven by the main current. The instrument consists of a heavy pendulum made in the shape of a disc of lead, which is kept in oscillation at the rate of about forty beats per minute by means of a coil shunted across the mains and taking about 0.4 watt for its operation. The amperemeter part of the instrument consists of a flat rectangular coil in two parts, surrounding a permanent magnet of the type employed in the Carpentier instruments. The movement of this is communicated to a metal sector, the lower end of which is cut to the shape of a curve determined by experiment, but generally similar to a logarithmic spiral. Against this curve the escapement movement actuated by the pendulum bears in such a way that when no current is furnished there is no movement communicated to the train of indicating wheels by the escapement, but as current flows and the sector above described moves, the escapement is permitted to work through larger and larger arcs and moves the train of wheels in a manner corresponding. By a long course of experiment and much re-designing this instrument has been brought to such a point that it consists practically of clockwork parts stamped, for the most part, out of brass. The pendulum is hung in stirrups, thus securing a bearing which is practically a roller bearing and almost free from friction. A very ingenious wiping contact for the coil actuating the pendulum is arranged, so that it keeps itself clean and free from oxidation indefinitely.

The instrument is made up and placed in a cast-iron case, having a dust-tight door which is sealed after it has been calibrated at the factory. This cast-iron case acts as a magnetic shield and effectually prevents any tampering with the instrument by means of magnets external to it. On the front of the meter can be read simultaneously the number of ampere hours registered and the amperes of current passing at the moment, the ammeter coil carrying a pointer working over a scale on the front of the instrument. The meters are calibrated for watt hours on the constant standard voltages of 110 or 220, and are direct reading, no constant being employed in this connection.

The difference between the two and three-wire meters consists of an extra amperemeter coil for the latter, one for each side of the circuit. Remarkable accuracy is claimed for these instruments, and tests of long duration have shown that the error averages about 0.7 of 1 per cent. The largest error that has been found in several hundred of these instruments is 3 per cent. The meters contain a plumb line, which serves for their orientation when they are placed in service. Nothing is required in the way of electrical knowledge for their installation, as any mechanic who can screw them against a wall so that the plumb line hangs free is able to put one in operation. The perfected form of meter described above is largely due to the efforts of Prof. William D. Marks, president of the American Electric Meter Company. Mr. George Ross Green is the secretary and treasurer of the company, and Mr. J. F. Stevens is its vice-president.

Eighty-seven Meters in Series—Testing for Accuracy.

NEWS OF THE WEEK

Financial Intelligence.

THE COLUMBUS STREET RAILROAD reports gross earnings for October of $50,131, an increase of $1995, as compared with the same month of last year, and net $25,232, an increase of $1173. For the ten months ending Oct. 31 the gross earnings were $504,226, a decrease of $25,475, as compared with the corresponding period of last year, and net $265,869, a decrease of $5169.

THE GROSS EARNINGS of the Edison Electric Illuminating Company of New York for the month of October last amounted to $214,580.60, an increase of $20,754.50, as compared with the earnings the same month last year. The net earnings were $91,398.65, an increase of $13,923.61. The increase in gross earnings for the ten months ended October 31, over the gross earnings for the same period last year, was $180,702.47; the net earnings increased $120,045.67.

AMONG THE REPORTS of the financial operations of street railway companies for the quarter ending September 30, are the following: The Brooklyn City & Newtown Railroad Company, Brooklyn, N. Y., reports gross earnings, $111,815; a decrease of $14,235, as compared with the gross earnings for the same period last year. The operating expenses were $65,380, a decrease of $11,435; net earnings, $46,435, a decrease of $2800. Net income, $18,410; a decrease of $416. The Buffalo Railway Company reports gross earnings of $378,875, an increase of $30,836; operating expenses, $176,240, an increase of $12,163; the net earnings increased $18,673, and the surplus increased $15,367. The Syracuse Rapid Transit Railroad Company's report shows an increase in gross earnings of $63,576; increase in operating expenses, $22,348; increase in net earnings, $41,228; increase in surplus, $24,611. The Crosstown Street Railway Company, Buffalo, N. Y., shows an increase of gross earnings of $10,807; increase in operating expenses, $11,485; decrease in net earnings, $678, and decrease in surplus, $3598.

Special Correspondence.

NEW YORK NOTES.

Office of THE ELECTRICAL WORLD,
258 Broadway, NEW YORK, Nov. 15, 1897.

MR. JOHN SANKEY, managing partner of the firm of Joseph S. Sankey & Sons, of Bilston, Staffordshire, England, is in this country on a tour of inspection among electrical establishments. Mr. Sankey's firm does the largest business in England in iron stamping for electrical purposes.

A TRAFFIC ARRANGEMENT, it is reported, is now under consideration in Brooklyn between all the railroads in that city, both surface and elevated. President Uhlman, of the Brooklyn Elevated Railroad, states that there is a likelihood of the arrangement being effected. The consolidation idea, he states, has been abandoned since it was shown that the conflicting interests could not be harmonized.

EXECUTIVE COMMITTEE MEETING OF THE NATIONAL ELECTRIC LIGHT ASSOCIATION.—President Insull has issued a call for a special meeting of the Executive Committee of this association, to be held Monday evening, November 22, at the Holland House, Fifth Avenue and Thirtieth Street, New York City, at which matters of considerable importance to the association will be taken up.

TO RING CATHEDRAL BELLS BY ELECTRICITY.—The committee of the Board of Trustees of St. Patrick's Cathedral of New York, are anxious to receive proposals with plans, specifications, etc., to ring by electricity the nineteen bells recently placed in position in the Cathedral. Mr. Cornelius O'Reilly is chairman of the committee, and his address is 109 East Forty-fourth Street, New York City.

AN INJUNCTION, obtained by a newspaper in this city, has caused the temporary suspension of work in providing landing facilities for the Bridge trolley cars at the New York terminal. It is alleged that the trolley cars will be a menace to life. The plans contemplate the construction of a subway for passengers, under the car tracks, so as to avoid the necessity of crossing the rails at grade in order to reach the promenade and the cable-car platform.

ANNUAL MEETING OF THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS.—The eighteenth annual meeting of the American Society of Mechanical Engineers will be held at the rooms of the Society, 12 West Thirty-first Street, New York City, from November 30 to December 2, inclusive. The two branches of engineering, mechanical and electrical, have become so closely interconnected that the conventions of the society representing either are of great interest to the other. Of the papers of the coming meeting there are several of particular interest to electrical engineers. Among them are the following: "Notes on Rating Electric Power Plants on a Heat-Unit Standard," by W. S. Aldrich; "Electricity in Cotton Mills," by W. B. Smith-Whaley; "Boiler Tests; the Classification of Data and Plotted Results," by W. W. Christie; "Reduction of Cost of Steam Power from 1870 to 1897," by F. W. Dean; "Multiple Cylinder Engines; Effects of Variation of Proportions and Variable Loads," by R. H. Thurston.

NEW ENGLAND NOTES.

BOSTON, Mass., Nov. 13, 1897.

THE ARMINGTON & SIMS ENGINE COMPANY, Providence, R. I., will go out of existence November 30, the creditors' committee having decided that the business cannot be profitably continued.

THE K & W COMPANY, Pittsfield, Mass., is entering the incandescent lamp field, and is just locating in a new building constructed especially for it, and in every way adapted for incandescent lamp manufacture. The company will also manufacture its well known specialties for central stations and isolated plants—K & W dynamo brushes, hanger boards, spark arresters and commutator compound—which have already earned for the company an excellent and enviable reputation. It is the intention of the K & W Company to manufacture an incandescent lamp which, for technical accuracy and mechanical finish will be in the lead of all competitors, and to cater particularly to that portion of the lamp trade who are seeking the best lamp on the market, and who are willing to pay a slight advance over cheap lamps. It confidently ly believes that there is always an open field for the best quality of goods at living prices. The lamp department will be under the charge of Mr. Salem M. Hardy, who is somewhat of a veteran in incandescent lamp manufacture, and who until recently was superintendent of the "Imperial" lamp factory at Marlboro, Mass. He brings with him to the K & W Company a force of skilled workmen who have virtually grown up in the lamp business. The lamp will be known as the "Hardy Incandescent Lamp." It is quite safe to assume that the company will secure a strong foothold for the "Hardy Incandescent Lamp." The officers of the K & W Company are W. A. Whittlesey, president; John H. Kelman, secretary; F. R. Whittlesey, treasurer, and Salem M. Hardy, manager lamp department. The Messrs. Whittlesey and Mr. Kelman are so well known as to require no special mention, and their association with the "Hardy Incandescent Lamp" would appear sufficient guarantee of its merits and success. The new home of this company is situated in the heart of Pittsfield, and is in close proximity to the headquarters of the Stanley Electric Manufacturing Company.

PHILAEELPHIA NOTE.

Branch Office of THE ELECTRICAL WORLD,
929 Chestnut Street,
PHILADELPHIA, Pa., Nov. 13, 1897.

A LECTURE entitled "The Booster System as Applied to Electric Railways," will be delivered by Mr. J. Lester Woodbridge, of New York, before the Electrical Section of the Franklin Institute, on the evening of Tuesday, November 23. Mr. William E. Harrington, of Camden, N. J., will also present a paper on "Railway Bonding."

SOUTHERN NOTES.

WASHINGTON, D. C., Nov. 13, 1897.

A TELEPHONE LINE from Hatteras to Ocracoke, N. C., is a desideratum and an effort is being made to get the Government to build such a line. A code of signals can then be used from the Portsmouth Life Saving Station.

AN ELECTRIC-LIGHT PLANT is being established at the Soldiers' Home for the lighting of the buildings and grounds. The wires have been erected under the direct supervision of the officers of the Home. On seventy-five of the poles clusters, each containing four incandescent lamps, have been placed. About 2000 lights have been placed in the Home buildings.

THE LINES of the American Telephone & Telegraph Company having reached Norfolk, Va., the residents of Wilmington, N. C., are anxious to secure like connections for that city. The long distance company is rapidly extending its lines southward, and there is every reason to expect that Wilmington will become a part of the system. The long distance company is building a line through the central part of the country, and it is completed as far South as Huntsville, Ala.

PLANS are being considered for the construction of a military telegraph line between Washington and Fort Washington, Md., and Sheridan Point, Va. It is the policy of the War Department to have all military posts in telegraphic or telephonic communication with the commercial systems, in order to insure the prompt presence of troops at commercial centres in cases of emergency. The ordnance, engineer and signal departments of the army are particularly interested in securing this communication, and a strong effort will be made to secure appropriation therefor at the coming Congress.

MILWAUKEE NOTES.

MILWAUKEE, Wis., Nov. 13, 1897.

WEST SUPERIOR, WIS., is talking of establishing an electric-light plant. The five years' contract with the Water, Light & Power Company expires in January, 1898.

NEENAH, WIS.—The interurban railway between here and Appleton has been completed to the Appleton City limits, and cars are expected to be running within a month.

OSHKOSH, WIS.—The Oshkosh, Omro & Berlin Electric Railway Company has petitioned the Common Council for a franchise from West Algoma to a point in the business part of the city.

THE BELL CITY RAILWAY COMPANY, of Racine, Wis., has filed a mortgage in this city for $250,000 in favor of the Illinois Trust & Savings Bank of Chicago. Of this amount $225,000 will cover the purchase price of the road, and the rest will be used in improvements.

NEW RAILWAY OPENED FOR BUSINESS.—On October 30 the Milwaukee, Racine & Kenosha Electric Road was formally opened and the officials of the road and prominent men made a trip from Racine to Kenosha and return. The road from Milwaukee to Racine has been in operation for some months.

St. Louis Notes.

ST. LOUIS, Mo., Nov. 12, 1897.

THE MISSOURI TELEPHONE MANUFACTURING COMPANY closed a contract last week which is said to be the largest of its kind ever made in St. Louis. It was to furnish a complete outfit for the telephone exchange at Ottumwa, Ia., consisting of 500 telephones. The order was given after a very strong competition with many other manufacturers.

THE INTERSTATE TELEGRAPH COMPANY is the title of a new local rival of the Western Union and Postal Telegraph Companies. It proposes to accept all kinds of business, including commercial messages and money transfers. It is a covering for a new attempt to nullify the anti-poolroom law. A wire to Chicago has been leased. A bet will be telegraphed to Chicago and then telegraphed back.

A NEW TELEPHONE COMPANY.—The Southwestern Telephone Company has been canvassing Belleville, Ill., for business for a new telephone system. The representatives claim to have secured 600 subscribers, and say that if the City Council will give them a franchise they will put $70,000 into the enterprise. They say that they will connect with St. Louis and East St. Louis through the Kinloch Telephone Company.

Pacific Coast Notes.

SAN FRANCISCO, Cal., Nov. 16, 1897.

THE GENERAL ELECTRIC COMPANY'S San Francisco offices have been moved to the eleventh floor of the new Claus Spreckels building. The company's warehouse is now located on Townsend Street, near Third.

THE YUBA POWER COMPANY has been incorporated by William M. Pierson, E. J. de Sabla, Jr., John Williams, John Martin and A. W. Linforth. Its objects are to operate water power electric plants, etc., in Yuba County, Cal.

PERSONAL.—Mr. Appleton, of the Electric Storage Battery Company, of Philadelphia, recently arrived in the city on business connected with the installation just placed in operation by the San Francisco Gas & Electric Company.

INDEPENDENT TELEPHONE COMPANY.—The San Francisco Board of Supervisors has given favorable consideration to a recent petition from the Peoples Mutual Telephone Company, asking for an extension of one year's time in which to expend $100,000 in the construction of telephone lines throughout the city. The company claimed that it had been delayed by litigation directed against it by competitors. The company guarantees to supply the city with free 'phones, and to allow the city free use of its conduits for fire and police telegraph wires, and also to pay 2 per cent. of the company's gross receipts into the city treasury.

THE SUNSET TELEPHONE & TELEGRAPH COMPANY has decided to close up the gap between its California and Oregon systems next summer. Direct conversations can then be carried on between San Diego, Cal., in Southern California and the British Columbia mining camps north of Spokane, Wash.; also via the Puget Sound system to the British boundary. The territory that will be covered by the new line extends along and adjacent to the Southern Pacific Railroad Company's right of way between Redding, Cal., and Eugene, Ore. The distance is 425 miles. At present the longest direct communication possible on the California lines is about 1100 miles; on the Oregon-Washington lines about 1400 miles. The contract for the completion of the line between Redding and Eugene City has been awarded to Lewis & Burkholder, of Cottage Grove, Ore. The contract calls for 14,000 cedar poles, 9000 of which are to be sawed and 5000 round, all to be cut from live, green timber, and to be ready for delivery by April 1, 1898. The Sunset Company has inaugurated a novel news service in Santa Barbara County, Cal. The towns in the northern part of that county will be supplied every morning at 8:30, with a résumé of the important news of the world, which will be posted in bulletins.

Canadian Notes.

OTTAWA, Ont., Nov. 13, 1897.

THE KINGSTON ELECTRIC STREET RAILWAY will be extended to Kingston Junction very soon, so it is reported.

PROPOSED ELECTRIC RAILWAY.—There is talk in Brantford, Ont., of constructing, at an early date, an electric railway from that city to Paris, Ont., a distance of 7 miles.

TORONTO CAPITALISTS are said to be inaugurating a scheme for the building of an electric railway between Woodstock and Ingersoll, both flourishing and large towns in the province of Ontario.

THE NEW QUEBEC ELECTRIC RAILWAY carried 243,000 passengers during September last. The new stock of $80,000, issued to raise the total stock value to $400,000, was at once taken by the former stockholders.

THE CITY COUNCIL OF ST. THOMAS, ONT., has decided to submit a by-law to the ratepayers on Tuesday, November 30, to guarantee the bonds of the street railway to the amount of $50,000, and pay the first year's interest, in consideration of the horse-car railway being electrified.

THE EARNINGS of the Toronto Street Railway Company for the months of July, August and September show an increase of $35,323 over those for the same period last year. This increase is said to be due to the running of cars on Sunday, and the several conventions which were held in Toronto during the past summer.

MR. H. J. BEEMER, of the Pontiac & Pacific Junction Railway, has a big scheme in hand. It is his intention to purchase the North Shore line of the C. P. R., and have the whole Quebec system operated by electricity, with headquarters in Hull. It is proposed also to operate the Gatineau Railway by electricity as soon as the first scheme is carried out. The plant will, in all probability, be located at Lachute, as that water power is amply sufficient to provide a motive power for such a system.

A COMPANY is said to have been organized at Hamilton, Ont., under President Myles, of the Hamilton, Grimsby & Beamsville Railway, with a capital of $200,000, to extend an electric railway from Beamsville to St. Catherines, a distance of 12 miles. The line will be commenced in the early spring. Much activity is being shown among the promoters of the electric road between Hamilton and Guelph. This road would have been constructed and in operation months ago, but for the opposition of the farmers of Waterdown and Mountsberg.

English Notes.

(From Our Own Correspondent.)

LONDON, November 3, 1897.

THE RONTGEN SOCIETY.—A new scientific society, to be called the "Rontgen Society," will commence its public career next Friday evening. The first president is to be Prof. Silvanus P. Thompson, F. R. S., whose work in connection with X-ray researches is well known on both sides of the Atlantic. The objects of this society, I believe, are to promote the study of Rontgen radiation, and to deal with all matters connected with that branch of physical research.

THE RHODIN ELECTROLYTIC PROCESS.—Last week I paid a visit to the famous Hotel Cecil to see a small model of an alkali and bleach electrolytic cell, the invention of Mr. J. G. A. Rhodin, of Manchester. I understand that works are about to be built for the commercial manufacture of caustic soda, and bleach by means of apparatus similar to the model I saw. The electrolyte used is brine, which is passed into a cast-iron cylindrical vessel heated from the outside, and in which it is electrolyzed between electrodes of carbon and mercury. The chlorine passes away through a central pipe to the lime chambers, where bleach powder is made. The sodium is absorbed into the mercury, and by an ingenious system of agitators is carried to an annular chamber filled with water, where it is converted into a solution of caustic soda. No use is at present made of the hydrogen. The advantages which are claimed for Mr. Rhodin's process are that the process is a continuous one, that a higher current density can be used than with any other process by the wet way, and that practically there is no loss of mercury. A further advantage is the facility with which the electrolyte may be kept nearly at boiling point during the process of electrolyzing, thereby lowering its internal resistance.

THE CENTRAL LONDON RAILWAY.—On Saturday afternoon last I had an opportunity of visiting a portion of the works which are being carried on in the construction of this important underground railway. In company with a number of engineers I descended one of the lift shafts to a depth of about 50 feet, where we encountered a cross tunnel leading to the two main tunnels that will form the up and down lines. The shaft, cross tunnel and main tunnels, are all lined with iron sections on the Greathead principle. I also had an opportunity of seeing two of the shields in action. One of these was a large shield something over 22 feet in diameter, for excavating the station tunnel. It is worked by 20 hydraulic rams, supplied with water under a pressure of one ton to the square inch. The other shield was occupied in excavating the main tunnel for the track beyond the station, and is worked in a similar way, though with a fewer number of hydraulic rams. I find that the average rate of progress with the large shield is about 1½ to 2 rings of the iron tunnel casing per diem, or, roughly, from 2½ to 3 feet. The material excavated is a wet kind of grayish blue clay, and although it is not strictly water bearing, and except at one of the stations an air lock is not necessary, it is sufficiently soft to be removed very readily by the Greathead system.

AN ALTERNATE-CURRENT ENCLOSED ARC LAMP.—A short time ago I had an opportunity to make some tests of a new alternate current enclosed arc lamp, the invention of Messrs. W. J. Davy and G. Thomas Davies, which is now being manufactured by the Davy Electrical Construction Company, of this city. I hope shortly to send you full particulars of the construction of this lamp, but in the meantime will summarize the tests I made. The lamp had two 13-mm cored carbons enclosed in a cylindrical globe of opal glass, which was placed on the mains of the Islington electric supply, which has an alternate current of 50 per second, the lamp being in series with a choking coil on the 100-volt mains. There were 68 volts across the arc, which measured about ½ inch in length, and 77 volts on the whole lamp. A current of 8½ amperes passed through the lamp. The candle power, measured in the horizontal plane passing through the arc, was 357, there being 540 watts supplied to the lamp. At an inclination of 45 degrees to the horizontal, the candle power was 420, the expenditure of power being the same as before. The consumption of carbon was at the rate of 3.62-mm per hour for the two carbons together. The light emitted from this lamp is steady and remarkably white, and the lamp appears to be altogether a commercial solution of the problem of running alternate lamps enclosed.

A NEW TYPE-PRINTING TELEGRAPH.—An invention by an Austrian electrical engineer, Herr Bernhard Hoffmann, is being put on the market in London, Berlin and Paris. It is a handy and compact type-printing telegraph,

the method of operating being extremely simple and requiring no learning, and the price being very little higher than that of an ordinary typewriter. Both transmitter and receiver are included in the same instrument. The apparatus is worked by uni-directional line currents, except at starting and stopping, when a reversal of the current is made to actuate a polarized relay for the purpose of synchronizing the two machines. It is not intended to compete in speed with the Hughes type-printing telegraph or similar instruments. As at present constructed, the average time taken for each letter is roughly half a second. The type wheel is actuated by clockwork, which is controlled by an electromagnetic mechanism receiving 14 impulses per second. Line currents of from 25 to 30 milliamperes are required, and it is stated that the capacity of the line does not interfere in any way with the working of the apparatus, satisfactory experiments having been made on a 13 microfarad line with 100 volts line voltage. I hear that experiments have also been made on the exchange lines of the National Telephone Company, but although satisfactory transmission was effected there is a serious impediment to its introduction in connection with telephone exchanges, owing to the intermittent currents dropping the ring-off indicators on the lines connected. It is also doubtful whether the Postmaster-General would license its use in this connection. The instrument is being made at present by the Société des Téléphones at their Paris works. In London it is being pushed by the "Telescriptor Syndicate," and the firm of Siemens & Halske have bought the German patents, and, I hear, are making experiments with a view to a possible increase in the speed of transmission.

General News.

THE TELEGRAPH AND TELEPHONE.

ST. LOUIS, MO.—A charter has been granted the Missouri Automatic Telephone Company, of this city.

MARIENVILLE, PA.—The Forest Telegraph & Telephone Company of this place has been incorporated.

CHATTANOOGA, TENN.—A telephone line is being built from Leighton to Sheffield by the citizens of the two towns. The distance is 12 miles.

NEW RICHMOND, WIS.—The Wisconsin Valley Telephone Exchange Company is erecting lines 60 miles north and 60 miles south of this city.

PORTLAND, ORE.—The Inland Telephone & Telegraph Company intends to build a telephone line from Heppner to Arlington, a distance of 50 miles.

HOUGHTON, MICH.—The Long-Distance Telephone Company is making arrangements for the extension of its lines from Detroit to the copper-mining districts, via Sault Ste. Marie.

CHICAGO, ILL.—Representatives of several independent telephone companies in this state met in Springfield on November 11 and effected an organization for the purpose of fighting the Bell Company on the Berliner patent.

NORTHPORT, WASH.—The Spokane and British Columbia and Vernon and Nelson telephone lines have been opened for business between Nelson and Rossland. This is the first telephone line built between Spokane and Nelson, B. C.

ROCHESTER, MICH.—The new State Telephone Company has opened an exchange in this place, and charges 10 cents for a conversation to all places within a radius of 40 miles. This is about one-half of the Bell Company's rates.

STREATOR, ILL.—A telephone line is being constructed between Garfield and Munster, and the question of extending the line to Streator is being agitated. This will give a continuous line from Magnolia via Wenona to Ottawa and Joliet.

CHARDON, OHIO.—The Bainbridge Telephone Company has completed its line between Chagrin Falls and Auburn Corners and from Bainbridge Centre and Howard's Corners, a total length of 13 miles. The entire line is metallic circuit.

ROCHESTER, MINN.—The Elgin and Plainfield Telephone Companies have effected an arrangement whereby the Elgin Company will build its line from Roselacks Corners, north of here, to Elgin, Viola, Haverhill and Rochester, where it will connect with the Rochester exchange and all the long-distance lines coming into the city.

FLINT, MICH.—The Bell Telephone Company has announced a rate of $24 for business houses and $18 for residences. The new Lansing Company, which is putting in a system, charges the same rates, and the State Telephone Company, which has a franchise, will enter the field at once. The two last named companies operate in opposition to the Bell Company.

ELECTRIC LIGHT AND POWER.

LAGRANGE, MO.—This city will establish an electric-light plant at a cost of $6000.

WINSTON, MO.—The Council is discussing the question of putting in an electric-light plant.

LEWISTOWN, ILL.—Lewistown's City Council is figuring on an electric-light plant for the town.

WARREN, OHIO.—The Warren Electric Lamp & Machinery Company will build a factory at this place.

WILLIAMSPORT, PA.—A move is now on foot to incorporate an electric light company to supply light for the town.

BRIDGETON, ME.—The authorities of this place have appointed a committee to report on the advisability of establishing an electric lighting plant here.

DALLAS, TEX.—The Postal Telegraph-Cable Company will extend its lines in the vicinity of Sherman and Dallas, Tex.

SABINE PASS, TEX.—The Western Union Company will build a telegraph line connecting Beaumont and Sabine Pass, Tex.

FAIRBURY, ILL.—Mr. C. C. McDonald, of this place, has purchased the electric-light plant at Eureka, and will improve the same.

SOUTH NORWALK, CONN.—The citizens have voted in favor of establishing a commercial electric-lighting system, to cost $20,000.

OCALA, FLA.—The City Council is agitating the question of issuing $36,000 worth of bonds for the erection of an electric-light plant.

TOTTENVILLE, S. I.—The New York & Staten Island Electric Company has begun the extension of its electric-light wires to this place.

CARTHAGE, MO.—At the election on November 2, the proposition to establish a municipal electric-light plant in this place was defeated.

JAMAICA, L. I., N. Y.—The Jamaica Electric Light Company has petitioned the Village Trustees for a franchise for twenty-five years.

WASHINGTON, D. C.—The United States Electric Lighting Company, of this city, is seeking permission to extend its conduits in certain streets.

COFFEEVILLE, KAN.—An election will be held December 5 to vote on the question of issuing bonds to the extent of $17,000 for an electric-light plant.

TONAWANDA, N. Y.—The Board of Trustees has contracted with the Tonawanda Lighting & Power Company for thirty-six arc lights at $90 per lamp a year.

FOWLER, IND.—The Fowler electric light plant has been leased to Messrs. Smith & Newkirk for three years. The firm will be in the market for material for improving the plant.

AVOCA, N. Y.—At a meeting of the Borough Council A. H. Squires, of Tunkhannock, was granted a franchise to place thirty-four arc lights in the borough at $85 per light per year.

NORTH BROOKFIELD, MASS.—A committee appointed to investigate the subject of an electric light system for North Brookfield, Mass., has reported in favor of establishing a municipal plant.

CLINTON, ILL.—The work of rebuilding the electric light plant in this place, which was recently destroyed by fire, is being pushed to completion, and it is expected to have the machinery in place in a few days.

PERU, IND.—The City Council has decided to build a new electric light plant. The new plant will have a greatly enlarged capacity as compared with the present one, and will be put into operation as soon as possible.

ELKIN, N. C.—Private parties will put in an electric-light plant to light this town. The contract for the same has been given to the Electrical Engineering & Supply Company, of Charlotte, N. C. Crocker-Wheeler apparatus will be used.

HOBART, IND.—The Town Board of Trustees of Hobart accepted the proposal of John P. Dales, of Crown Point, for the construction of water works and electric-light plant at the cost of $20,500. The plant will be completed this year.

BRISTOL, TENN.—The City Council has granted a franchise to Caldwell & Dulaney for the construction and operation of an electric light and power plant in Bristol. The plant is to be built in connection with the proposed extension of the city street railway system.

WELLAND, ONT.—The partnership heretofore existing between Messrs. C. J. Page and J. Wilkerson, under the title of the Welland Electric Light Company, has been dissolved by mutual consent. All debts to the firm and all claims against it will be settled by Mr. Page.

SHERIDAN, IND.—The town of Sheridan will soon be lighted by electricity. The Town Board, at its last regular meeting, voted to let the citizens decide whether the town should put in and own the plant or not. More than two-thirds of the voters signed a petition favoring the purchase.

YONKERS, N. Y.—The Yonkers Electric Light Company has filed a mortgage on its property in favor of the Central Trust Company, of New York, in the sum of $200,000, as security for the payment of $200,000 in bonds, dated July, 1892. The bonds become payable thirty years after that date.

INDEPENDENCE, ORE.—The City Council has had under consideration for some months the purchase of the present electric light and water plants, owned by two companies, but at the last meeting the committee in charge of the matter decided against paying the price asked. Further negotiations are in progress.

SAGINAW, MICH.—The Holland Trust Company, of New York, has applied for a receiver for the Saginaw Electric Light & Power Company, pending the foreclosure of a mortgage given in 1889 to secure payment of $50,000 first mortgage bonds. The liabilities of the company are placed at $70,000, and the assets $42,000.

THE ELECTRIC RAILWAY.

SHENANDOAH, PA.—An electric railway is to be built from this place to Ringtown.

ONEONTA, N. Y.—The Oneonta & Otego Valley Railroad Company will erect a power house.

WEBSTER, MASS.—The Selectmen voted a franchise to the Webster and Dudley Electric Railway.

PITTSFIELD, MASS.—The street railway company of this place will extend its road to Tillotson.

BOSTON, MASS.—The Quincy & Boston Electric Railway Company is seeking permission to extend its lines to Braintree.

AMBLER, PA.—Right of way is being secured for the projected electric railway between this place and Norristown, Pa.

NEWTON, MASS.—The Newton Street Railway Company is said to be planning to erect at an early date a new power station.

EAST AURORA, N. Y.—The Board of Trustees have granted a franchise to the Buffalo, Hamburg & Aurora Electric Railway Company.

WILKESBORO, N. C.—Wilkesboro and Taylorsville are trying to organize a company to build an electric-car line to connect the two towns.

GRAND RAPIDS, MICH.—An electric road is to be built from Ludington to Hesperia. The power house of the new line will be located at Hart.

ATLANTIC CITY, N. J.—An electric railway to run on Virginia Avenue, this city, is projected. Council will soon be asked to grant a franchise.

WATERVILLE, ME.—The Waterville & Fairchilds Electric Light & Railway Company will expend $40,000 enlarging and otherwise improving its plant.

RACINE, WIS.—The Belle City Railway Company, of this place, has mortgaged its plant for $250,000. Of this amount $25,000 will be used for improving the road.

BALTIMORE, MD.—Mayor Hopper signed a permit authorizing the City Passenger Railway Company to erect the poles necessary to electrify the Red and White lines.

GRAND VIEW BEACH, MD.—It is reported that a Mr. Seymour, acting for the Chesapeake & Ohio Railroad, will build an electric railway from Buckroe to Grand View Beach, Md.

LYKENS, PA.—An electric road will probably be built from this place to Tower City. Dr. S. Ritter Ickes, representing a Harrisburg (Pa.) syndicate, is at Lykens looking over the field.

BROOKLYN, N. Y.—The Brooklyn Heights Railroad Company will shortly apply to the Board of Aldermen for a franchise for the new route from Flatbush to Bath Beach and Bensonhurst.

PALMER, MASS.—The Palmer-Monson Electric Railroad Company has secured right of way for its projected road from Palmer to Monson, and contracts for construction and equipment will be let soon.

GAINESVILLE, GA.—Mr. B. H. Hall, of Atlanta, is now making a survey for an electric line of railroad from this place to Dahlonega. It is reported that Mr. G. W. Scott, of Atlanta, Ga., is behind the movement.

UTICA, N. Y.—It now begins to look as if the electric street railway will soon be extended to this place, the village board of Frankfort, N. Y., having granted a franchise to Beckwith & Quackenbush for that purpose.

OSHKOSH, WIS.—The Oshkosh, Omro & Berlin Electric Railway Company has asked the Council of this city for a franchise. Right of way for most of the distance between that city and Berlin, Wis., has been secured.

GOSHEN, IND.—The Michigan, Indiana & St. Louis Electric Railway Company has completed its organization, and will at once begin the work of securing right of way for its proposed electric line from this place to Danville, Ill.

YOUNGSTOWN, OHIO.—The Mahoning Valley & Southeastern Electric Railway Company has secured right of way for its proposed railway from Youngstown, Ohio, to Struthers. The line will probably be continued to Pittsburg, Pa.

BELAIR, MD.—W. P. Husband, of the Havre de Grace & Belair Electric Railway Company, made application to the County Commissioners for a right of way over county roads between this place and Aberdeen, and thence to Havre de Grace.

HAVERHILL, MASS.—The Plumb Island Electric Street Railway Company has made application for authority to issue $30,000 of original stock for the purpose of substituting electricity for horse power on its system and extending its lines.

COUNCIL BLUFFS, IA.—The citizens of this place will vote on a proposition to grant the Manawa Railway Company a franchise to extend its electric lines and build a power house. The company contemplates the expenditure of $300,000.

OTTAWA, ONT.—Some interesting information concerning Canadian railways appears in the Canadian Year Book, recently issued by the Department of Agriculture. The total length of electric railway in the Dominion in 1896 was 56 1-3 miles of rails.

NEW YORK CITY, N. Y.—The Pelham Park Railroad Company petitioned the Board of Aldermen for a franchise to construct a surface street railroad from Bartow Station to City Island, with a branch to the city limits at Pelham Manor. The petition was referred to the Railroad Committee.

HARTFORD, CONN.—The Central Railway & Electric Company has granted long-service badges to its employees. The badges bear the company's monogram, and are worn on the lapel of the coat. Each motorman and conductor who has been in the service of the company for five years has received one of these badges.

BALTIMORE, MD.—The Baltimore City Passenger Railway Company has decided to introduce electric power on its Red and White lines, and as soon as permission from the authorities can be obtained for the erection of the poles the work of transformation will be commenced without delay. These lines are at present operated by cable power.

AKRON, OHIO.—It is reported that the Akron Street Railway Company and the Akron & Cuyahoga Falls Rapid Transit Company are to be consolidated. Negotiations to this end have been pending for some time, and Messrs. George W. Crouse and F. A. Sieberling, of the Akron Street Railway Company, and F. F. Welsh, of the Akron & Cuyahoga Falls Rapid Transit Company, have been in New York in connection with the project.

BENNINGTON, VT.—The Bennington Electric Railroad Company and the Hoosick Railway Company have been consolidated, the name of the consolidated company being the Bennington & Hoosick Valley Railway Company. The capital of the new concern is $160,000, and the directors are Galen C. Moses, Bath, Me.; Edward L. Bates and Irving E. Gibson, of Bennington, Vt.; William C. Goer, Troy, and George E. Greene, Joseph Buckley, Watson M. Holmes, Levi Warden and G. Frank Rising, of Hoosick Falls.

SOUTH ORANGE, N. J.—On November 10 the South Orange & Maplewood Street Railway Company opened the new extension of its road to Main Street, West Orange. On the afternoon of November 9 several invited guests were taken over the line in a special car from the Main Street terminus to South Orange and return. In the evening a dinner was served to the guests, which was presided over by Mr. Frank Brewer, president of the railroad company. Mr. Brewer himself and Mr. F. V. L. Turner, superintendent of the line, looked after the welfare of the party during the trip and evening. This line is unique in that it runs over private right of way throughout its entire length, except where it crosses streets. At the street crossings a very substantial construction has been adopted. The rails are laid on a bed of 6 inches of concrete, which is topped with vitrified brick, the spaces between the bricks being cemented. This gives a very solid construction, which greatly facilitates the passage of vehicles over the tracks at these crossings. The entire line is stone ballasted, and is of steam road construction throughout. From 6 inches to 9 inches of stone ballast are laid. The rails weigh 58 pounds to the yard. The railroad company obtains its power from the Newark Electric Light & Power Company's station at West Orange. The cars are equipped with General Electric apparatus, and are provided with vestibules, in conformity with the New Jersey State law. The cars are heated with electric heaters of the Consolidated Car Heating Company, of Albany, N. Y. The West Orange terminus of the line is directly opposite the West Orange station of the Watchung branch of the Erie Railroad. The South Orange & Maplewood Street Railway Company expects to carry its line across Main Street and run right to the Watchung depot. As yet, however, it has not been able to obtain the franchise to extend the line across the street, but there is every reason to believe that this will be obtained in the near future. The line passes through the Orange Valley, and has brought about considerable improvement in landed property along the line.

Personal Notes.

MR. WALTER P. PHILLIPS, formerly general manager of the United Press, has entered the service of the Columbia Phonograph Company, with headquarters in New York.

MR. WALTER G. WHITMORE, of the New York office of the General Electric Company, and Miss K. Marcellus-Buttrick, of Bay Ridge, L. I., N. Y., were united in marriage on October 12 last, at the home of the bride's parents. Mr. Whitmore is a graduate of the Massachusetts Institute of Technology, and was connected for some time with the Chicago Edison Company. He afterward joined the engineering staff of the Edison General Electric Company, and after the formation of the General Electric Company he was placed in charge of the entire electrical construction work of the New York office, with the title of local engineer. Mr. and Mrs. Whitmore have the best wishes of a large circle of friends for their future happiness.

Trade and Industrial Notes.

THE CITY OF HANNIBAL, MO., has ordered from the Murray Iron Works Company, Burlington, Ia., a Sioux Corliss engine of 450 horse-power. This is to be installed alongside an engine of similar pattern that has been in continuous operation for some years, the intention being to sell more power.

THE YOUNGSTOWN BRIDGE COMPANY, Youngstown, Ohio, whose shops were destroyed by fire in October last, has begun the construction of new shops, which, when finished, it is said will be the most complete bridge shops in this country. The various buildings will be constructed of steel throughout.

THE FERRACUTE MACHINE COMPANY, Bridgeton, N. J., recently shipped a number of large presses to the Jeffrey Manufacturing Company, Columbus, Ohio. The latter concern is increasing its line of conveyors, elevators and other special machinery, and the outfit just sent it by the Ferracute Company will enable it to produce very rapidly some of its articles which were formerly made by hand. The Ferracute Company is also shipping a number of presses abroad for electrical and other work. It is preparing a new catalogue, which will be issued within a few months, also a sheet circular describing its line of over 300 presses and other sheet metal machines. The company is very busy, and is running its shops with a full force.

THE NEW EXTENSION of the plant of the Electric Arc Light Company, New York City, is now completed, and the added facilities enable the company to produce 1000 lamps per month. The company states that with the new facilities thus secured and with the large amount of business it is doing it is enabled to effect a saving, which it is its purpose to give to the customer. It announces a reduction in the price of its standard brass lamps, and the company looks for liberal support in the trade. It is understood that the owners of the Marks patents are beginning a most vigorous crusade against all infringers of the same. These patents, it is stated, cover all types of enclosed-arc lamps, except such made by licensed manufacturers.

THE PARTRICK & CARTER COMPANY, 125 South Second Street, Philadelphia, which is one of the oldest electrical supply houses in the trade, has just issued a very complete catalogue of its products. This concern manufactures and handles house goods and general electrical supplies, and its annunciator system for hotels and private dwellings is among the most popular. This house produces call and alarm systems of all kinds, including annunciators, fire alarms, telegraph and telephone apparatus, call bells, etc. The catalogue contains 124 pages, and is very completely illustrated with the long line of supplies handled by this company. Its size is the same as that of all of its predecessors. The Partrick & Carter Company was established in 1867.

COMBINATION OF STEEL-TUBE MANUFACTURERS.—On November 12, at Toledo, Ohio, five American steel-tube manufacturing companies effected a combination to control the output of steel tubing in this country. It is stated that the new combination will have a minimum capacity of 50,000,000 feet per year. This is said to be equivalent to 90 per cent. of the total output. The Shelby Tube Company, Shelby, Ohio; the Brewer Seamless Tube Com-

pany and the American Weldless Tube Company, of Toledo; the Ellwood Tube Company, Ellwood, Pa., and the Greenwood Tube Company, Greenwood, Pa., are the concerns interested in this combine. Mr. W. H. Miller, of Shelby, will be the president and general manager of the new company, which will be known as the Shelby Steel Tube Company. Its capitalization is $5,000,000.

MESSRS. EUGENE MUNSELL & CO. and the Mica Insulator Company, of 218 Water Street, New York, and 117-119 Lake Street, Chicago, announce that they carry at all times a large stock of their "three great lines of insulations," Mica, Micanite and M. I. C. Compound, and are in a position to supply at short notice special forms of insulation for any system of electrical apparatus. They make a specialty of the prompt filling of orders, both from their stocks at New York and Chicago, as well as at their local agencies in the following named cities; Cuyahoga Supply Company, Cleveland, Ohio; Arthur S. Partridge, St. Louis, Mo.; Sinclair Randall, Cincinnati, Ohio; Brooks-Follis Electric Company, San Francisco, Cal. M. I. C. Compound is their latest production, and is commanding considerable attention in the electrical trade.

THE PHŒNIX CARBON MANUFACTURING COMPANY, St. Louis, Mo., has just issued a catalogue describing a portion of the various carbon products manufactured by this concern. The different forms of battery produced by this company are illustrated in perspective and section, the latter views giving an excellent idea of their construction. Directions for the charging of the cells are also given, together with the dimensions of the same. Some valuable information regarding batteries of different types and instructions for their maintenance form a valuable part of the catalogue. A great variety of forms of zincs are also illustrated. The Phœnix Street railway motor and generator brushes are described, and illustrated in copper color, and arc-light carbons are also treated in like manner. Col. C. G. Booker is to be congratulated on his successful work in producing this catalogue.

THE SWEDISH TELEPHONE.—There seems to be an impression in the trade that the Swedish (Ericsson) telephone is imported and handled in this country by several concerns. This, however, is not the case. Only one house enjoys the right to carry on the business of importing these instruments and trading with them in this country, and that firm is Messrs. Smith & Patterson, 10 Warren Street, New York City. The firm, however, has distributing agents through whom their telephones reach the trade. The Ericsson telephone has attained an excellent reputation in this country for its efficiency of operation and attractive design. It is a very serviceable instrument, and is said to be unexcelled by any other for all classes of telephone service. Messrs. Smith & Patterson are the sole agents in the United States for this instrument, and are prepared to fill all orders for the same with promptness.

NEW TYPES OF X-RAY APPARATUS.—We are in receipt of a very interesting and artistic booklet, entitled "Concerning X-Ray Apparatus," and issued by Mr. James G. Biddle, 910 Drexel Building, Philadelphia. This pamphlet is published in the interests of the Willyoung X-ray machines, and the new "Jagabi" self-adjusting X-ray tube, for which Mr. Biddle is sole selling agent. It is well illustrated with radiographs and diagrams, showing the plan of the various types of apparatus used in X-ray work. Illustrations of the apparatus itself, tubes and accessories, are also shown. Among the interesting sub-headings of this booklet are the following: The Sources of Electrical Supply; Induction Coil or Tesla Coil; To Produce the X-Rays by the Use of a Static Machine: Practical Uses of the X-Ray; How to Procure the Right Outfit; "Jagabi" Adjustable Lighting Tubes, etc. Each topic is simply and thoroughly treated, in a way that should be intelligible and helpful to intending purchasers.

THE CROSBY STEAM GAGE & VALVE COMPANY, 97 Oliver Street, Boston, Mass., has made a name in the trade not only for its products, but for the excellence of the manner in which it describes and illustrates the same in its catalogues. The latest catalogue of this company, which has just been issued, is a very complete work of its kind, and contains illustrations and descriptions of the long line of steam gauges, valves and other steam appliances manufactured and handled by this company. The special features of the catalogue are the Crosby indicator, spring seat valve, and recorders. Of the latter those of special note are the mine and draught recorder. A new feature, also noticeable in the catalogue, is the marble gauge tablet, which is made in a variety of forms for the accommodation of gauges, clocks, etc. The tablets are made in black, Knoxville and white marble, and present a handsome appearance. The Crosby steam indicator is evidently much favored by engineers in general, judging from the number of excellent testimonials given at the back of the catalogue. A well arranged index is also provided for reference.

ICE AND REFRIGERATING MACHINES constitute the subject of Catalogue No. 29, just issued by the Murray Iron Works Company, Burlington, Iowa. The process of ice making and mechanical refrigeration is succinctly described for the information of those who have little knowledge on this subject. The various refrigerating machines made by the company are also described, and many illustrations give an excellent idea of the character of the apparatus used in refrigerating plants. The company pays particular attention to the building of small refrigerating machines, and owing to the large experience which it has had in this work it considers itself well able to cater to this class of trade. Practical examples of the uses of refrigerating are illustrated, as well as the component parts of such a plant, including the Sioux Corliss engines, which are manufactured by this company. Other products of the Murray Company are also described and illustrated. These include, besides the Corliss engines, the horizontal tubular boiler, vertical tubular boilers, steam pumps for stationary, marine and portable boilers, and feed-water heaters.

THE C & C ELECTRIC COMPANY, New York, is still experiencing a steady demand for its bipolar type of dynamos, with curved field magnets. Its recent type of entirely enclosed slow-speed iron-clad motors promises to become as popular as its older types, and the company states that there is a large demand for these iron-clad machines. Their enclosed feature makes them particularly desirable for use in places where dust, gases, moisture, etc., would be injurious to an open type machine. These machines may be placed and satisfactorily operated in any position. Their slow speed and peculiar construction permit of their being either direct-connected or back-geared to any machine shaft. The C & C Company's new line of slow-speed multipolar generators and motors also seems to meet with a favorable reception. A large number of these machines are already in use, and the company states that a large number is under construction on orders and for stock. A very attractive set of illustrations of these machines mounted upon heavy board prepared for hanging up is being sent out by the C & C Company to those interested in its apparatus. Mr. Campbell Scott, general sales agent of the company, states that its extensive factory at Garwood, N. J., is kept busy night and day in producing its apparatus, and that this is one of the busiest seasons in the company's history.

Business Notices.

THE ILLUSTRATIONS in this issue were made by the Photo-Engraving Company, 67-71 Park Place, New York City.

A NEW THROUGH PASSENGER ROUTE FOR COLORADO, UTAH AND CALIFORNIA.—The Chicago *Times-Herald* of August 27 says that on September 12 the new traffic alliance between the Chicago, Milwaukee & St. Paul Railway and the Chicago, Rock Island & Pacific Railway goes into effect, and on that date the former will send its first Denver sleeper out of Chicago. This will be attached to its regular night train for Omaha, and will be delivered there to the Rock Island. On October 2 the tourist car route over these two lines, the Colorado Midland and Southern Pacific, will be inaugurated. Tourist cars will be run once a week between Chicago and San Francisco. For further details regarding this new route call on or address E. F. Richardson, General Agent Passenger Department, C., M. & St. P. Ry., 381 Broadway, New York City.

Illustrated Record of Electrical Patents.

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[In charge of Wm. A. Rosenbaum, 177 Times Building, New York.]

593,187. ELECTRICAL INSTRUMENT; W. C. Banks, New York, N. Y. App. filed March 12, 1897. The combination of a circuit, including a resistance, a generator, an electromagnetic circuit breaker, the latter two of which are always in circuit, a second resistance and a short circuit about it, all arranged whereby the removal of the first resistance will operate the circuit breaker to open the short circuit about the second resistance, and constitute its circuit a part of the only complete circuit through the generator.

593,193. BATTERY CUP; J. A. Britton, Phillipsburg, N. J. App. filed Nov. 7, 1896. In a gravity battery, the combination, with a jar, copper and zinc, of a cup comprising a rigid cylinder open at the top and bottom, and provided with suitable supports adapted to rest upon the top of the jar, and a removable textile bottom secured over the lower end of said cylinder so as to permit the free passage of the liquids in the jar, but prevent the decomposed portions of the zinc from dropping to the bottom of the jar and encrusting the copper.

593,230. MAGNETIC-CIRCUIT BREAKER; D. McF. Moore, Newark, N. J. App. filed June 24, 1896. A circuit breaker having a tongue or vibrating part in magnetic equipose and means for intermittently moving it from equipose.

593,237. ELECTRIC SWITCH FOR CHANDELIERS OR BRACKETS; J. W. Parkin, Philadelphia, Pa. App. filed Jan. 26, 1897. An electric switch for chandeliers, etc., a casing having openings in its sides, a cap covering an opening in said casing, a rotatable stem in said casing, a non-conducting plug through which said stem passes, contact points carried by said plug, conductors connected with said contact points, contact devices mounted on and insulated from said stem, adapted to contact with said points, and a groove in the under side of said plug adapted to sustain the conductor, whereby said plug is prevented from turning.

593,244. SYSTEM OF ELECTRICAL DISTRIBUTION; C. F. Scott, Pittsburg, Pa. App. filed Jan. 12, 1895. A system of electrical distribution comprising an alternating-current generator, its circuit, and translating devices fed thereby, and a step-up transformer interposed in the circuit approximately midway between the generator and translating devices for raising the E. M. F. to substantially the maximum limit allowable at the generator.

593,245. APPARATUS FOR PARTY TELEPHONE LINES; C. E. Scribner, Chicago, Ill. App. Filed March 16, 1897. The combination, with a normally complete metallic line circuit, of appliances included serially in the circuit at different stations, means in the line circuit for exciting the said instruments through the agency of current in the complete circuit, other appliances connected with each of the line conductors, a relay at one extremity of the circuit adapted to sever the connection between the line conductors there, means at the other terminal of the circuit for applying current to either line conductor to determine the operation of the said appliances connected therewith, and means controlled from the same terminal for exciting the said relay to break the connection between the line conductors, whereby the appliances in the line conductors may be excited by current in the complete circuit, or either line conductor may be isolated from the other to permit the operation of the appliance connected therewith.

593,283. CONSTRUCTION OF END RINGS FOR COMMUTATORS; S. H. Short, Cleveland, Ohio. App. filed May 3, 1897. A continuous end ring for commutators, built up of strips of insulation, each strip successively

shaped to conform to the commutator bars, and the whole set to proper shape.

593,286. ELECTRIC SWITCH; H. E. Waite, New York, N. Y. App. filed May 28, 1897. A switch arm, provided with a contact piece, having one contact of a width less than the distance between two adjacent co-operating contacts, and having another contact piece of a width sufficient to bridge the two adjacent co-operating contacts, and means whereby either of the contacts may be brought into operative position.

593,301. TROLLEY; E. Lane and J. A. Snyder, Johnstown, Pa. App. filed April 24, 1897. The combination, with two trolley poles, each carrying a yoke and a trolley wheel journaled between said yokes, of means for shifting the trolley wheel laterally independent of the trolley pole.

593,314. SIGNALING SYSTEM; C. B. Sterling, New York, N. Y. App. filed Feb. 25, 1897. In a signaling system, supply conductors, a circuit closer, an electromagnet and an automatically operating circuit maker and breaker controlled by said magnet, all included in the supply circuit, and a branch circuit including said circuit maker and breaker, and a plurality of alarms, in combination with means for moving the circuit closer into position, a lock or latch for holding it in said position, and means for freeing the same.

593,332. BATTERY ZINC; D. Ogden, Columbus, Ind. App. filed Dec. 24, 1896. The combination, of an electrode, means carried thereby for interlocking with a similar electrode, and means by which two such electrodes may be independently held in a cell, the arrangement being such that one electrode will lie immediately beneath the other.

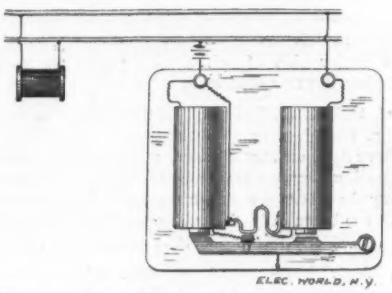
593,335. LOCK-CIRCUIT CLOSER; C. E. Pierce, New York, N. Y. App. filed July 2, 1896. The combination, with a bolt and its keeper, of a lever fulcrumed on the keeper and engaged by the side of the bolt, as the bolt moves laterally upon the forcing of the door, and two contacts carried by the support and normally disconnected with each other, the contacts being engaged and connected by the movement of the lever.

593,369. RETURN-WIRE CONNECTION FOR ELECTRIC RAILWAYS; J. H. Bickford, Salem, Mass. App. filed March 15, 1897. A standard cable, connectors for connecting the ends of the strands of said cable directly to a rail, consisting of short pieces of wire, rods or bars connected at one end with the strands of said cable and connected at the other end to the rail.

593,372. TELEPHONE SYSTEM; W. W. Dean, St. Louis, Mo. App. filed July 12, 1897. In a telephone-exchange system, the combination, with a telephone line and a party telephone line extending from the exchange, of a cord circuit for forming a continuation of the first aforesaid telephone line, a plurality of connecting plugs each severally adapted to connect the cord circuit, and the first aforesaid telephone line with the party telephone line, signal bells at the subscribers' stations of the party line, and a source of signaling current connected or adapted to be connected with each connecting plug, each connecting plug corresponding to a subscriber's station of the party line and adapted to include signaling current in circuit with the signal bell thereat, the bells at the remaining station or stations being irresponsive to the signaling current thus included in circuit with the bell at the selected station.

593,381. INSULATING JOINT; W. H. Lau and P. S. Bredsvold, Chicago, Ill. App. filed Feb. 12, 1897. In an insulating joint for gas piping, the combination of an outer shell having internal screw threads and an internal inwardly flaring shoulder, with parts fitting into the shell, one of such parts having an external screw thread fitting into the screw threads on the shell and the other of such parts having a shoulder corresponding with the shoulder in the shell, both of such parts having at adjacent ends radial grooves, a layer of non-conducting material interposed between the shoulder in the shell and the adjacent shoulder on one of the inner parts, a layer of non-conducting material interposed on the radial grooves between the ends of the inner parts and a washer which is both gas tight and non-conducting when under pressure interposed between the ends of the inner parts, peripheral ribs on the screw threaded one of the inner parts, and the outer shell forced into the grooves formed by the peripheral ribs.

593,388. CONSTANT-CURRENT DYNAMO; C. N. Black, New Haven, Conn.

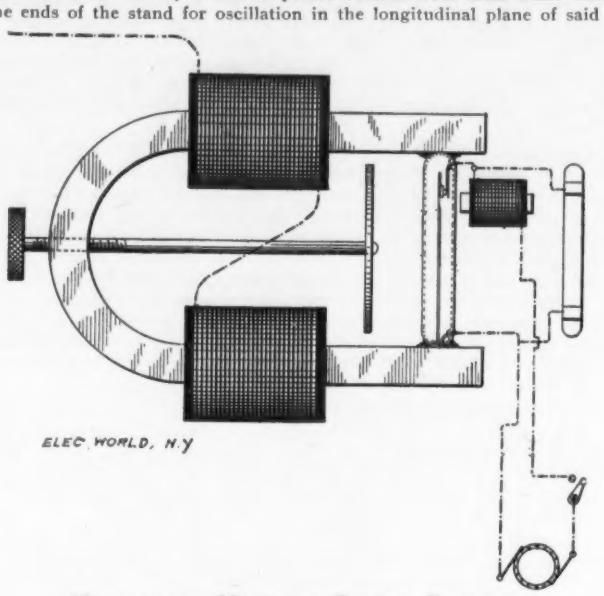


No. 593,187.—ELECTRICAL INSTRUMENT.

App. filed Feb. 1, 1897. An open coil, constant-current dynamo, having the terminals of its individual bobbins or sets of connected bobbins connected to segments of different commutator rings.

593,394. MULTIPLE-SWITCHBOARD SYSTEM; F. C. Hughs and G. W. Kelley, Detroit, Mich. App. filed Feb. 1, 1892. In a telephone system, the combination of line circuits having two limbs, one of which contains an annunciator, spring jacks connected with said limbs, electromagnets in circuit with their respective jacks through auxiliary lines, said magnets controlling a circuit breaker in the respective limbs of the line circuits, a set of plugs connected by three cords, two of said cords having each a magnetic coil therein that actuate the clearing-out drop, and which form a part of the talking circuit, the third cord having a battery or course of electricity thereon, said plugs being adapted to be inserted in their respective "jacks" to connect the subscribers, and at the same time energizing the magnets in the auxiliary line, to break the annunciator circuits.

593,424. TROLLEY POLE AND STAND; F. A. Seaver, Hartford, Conn. App. filed March 29, 1897. The combination, with a suitable supporting base, of a long trolley stand pivoted thereto for transverse rocking movement, and held against turning in the direction of its longitudinal axis; expansible springs between said stand and base at opposite sides of the longitudinal axis of the trolley stand; a trolley pole having two pairs of connected toggle arms, one pair supporting the trolley, the other two toggle arms being connected with the toggle arms of the first pair and pivotally secured to the trolley stand at points remote from each other and near the ends of the stand for oscillation in the longitudinal plane of said stand



No. 593,230.—MAGNETIC CIRCUIT BREAKER.

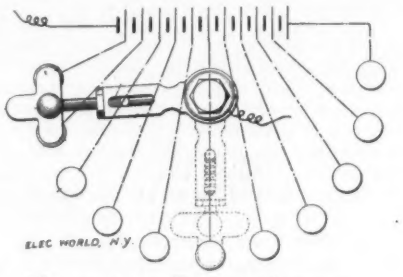
and adapted to form therewith a long, firm support for the trolley pole; and springs connected to the lower toggle arms, between the ends thereof and also connected to the base at points beyond the ends of the trolley stand for normally raising the trolley.

593,442. JOINT OR COUPLING FOR ELECTRIC CABLES; G. Tailleur, Chicago, Ill. App. filed July 31, 1897. The combination, with conductor or cable ends, of interlocking terminals, insulating sleeves connected to said conductors and having opposing flanged ends and a two-part coupling engaging the flanged ends of said sleeves and serving to hold the terminals and the sleeves together.

593,467. TIP FOR TELEPHONE CORDS; J. W. Gottschalk, Philadelphia, Pa. App. filed Oct. 6, 1897. The combination of an electrical conductor, a pin and a clamp having a perforated end slipped over the pin, with means for holding the clamp onto the electrical conductor.

593,481. AUTOMATIC CIRCUIT BREAKER; W. G. Lowrie, Newark, N. J. App. filed April 24, 1897. The combination of a source of electric energy, a magnetic field created thereby, a circuit breaker controlled by the magnetic field, and means for short circuiting the field and breaking the circuit when the current exceeds a certain strength.

593,504. AUTOMATIC BLOCK SIGNAL; J. M. Williams and T. P. Kinney, Danville, and H. W. Kinney, Lynchburg, Va. App. filed May 28, 1897. In an electric signal, the combination, with a suitable housing, of a signal arm mounted thereon, a reversible motor in said housing, means for connecting the said motor with the said arm, whereby the motor is adapted to impart a positive movement thereby, both to raise and to lower the same, track



No. 593,286.—ELECTRIC SWITCH.

instruments for closing a circuit through the said motor, means for reversing the circuit through the motor and means operated by the moving parts of the signal operating means, separate from said track instruments, for cutting them out of circuit after they have been operated by a train passing upon a block, and means for placing the said track instruments into circuit again when the train passes from the block.

593,510. ELECTRIC CIRCUIT CONTROLLER; J. H. Bowley, Washington, D. C. App. filed Feb. 24, 1897. An automatic regulator for electric circuits, consisting of a receptacle having a base and neck portion, said neck having an upper and lower compartment, a float mounted in the lower compart- having fingers designed to engage the ends of the wires forming the circuit. ment of the neck, a standard erected upon said float and in said neck, and having fingers designed to engage the ends of the wires forming the circuit.